

NASA REAUTHORIZATION

HEARING

BEFORE THE

SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND
SPACE

OF THE

COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

MAY 8, 2002

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

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CONTENTS

Hearing held May 8, 2002	Page 1
Statement of Senator Allen	5
Statement of Senator Burns	8
Statement of Senator Dorgan	7
Statement of Senator Hollings	1
Prepared statement	2
Statement of Senator Hutchison	32
Statement of Senator Nelson	20
Statement of Senator Wyden	1
Prepared statement	4

WITNESSES

O’Keefe, Sean, Administrator, National Aeronautics and Space Administra- tion	10
Prepared statement	14

APPENDIX

Response to written questions submitted to Sean O’Keefe by:	
Hon. Barbara Boxer	83
Hon. Ernest F. Hollings	49
Hon. John McCain	51
Hon. Bill Nelson	79

NASA REAUTHORIZATION

WEDNESDAY, MAY 8, 2002

U.S. SENATE,
SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 9:30 a.m. in room SR-253, Russell Senate Office Building, Hon. Ron Wyden, Chairman of the Subcommittee, presiding.

OPENING STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

Senator WYDEN. The Subcommittee on Science, Technology, and Space will come to order. We're very pleased to be able to be joined this morning by the chairman of the full committee, Senator Hollings, who has been so supportive of the agenda of this Subcommittee, and I want to recognize him at this time.

STATEMENT OF HON. ERNEST F. HOLLINGS, U.S. SENATOR FROM SOUTH CAROLINA

The CHAIRMAN. Well, I thank you very much, Mr. Chairman, and I want to thank you particularly for conducting this hearing. I wanted to appear personally to praise and thank our friend, Sean O'Keefe. I met him when he was working for Senator Stevens on our Appropriations Committee. If he can handle Ted Stevens, he can handle space. I can tell you that right now. But he's had even a further induction as the Secretary of the Navy over there in the Pentagon and as the deputy director of our Office of Management and Budget. He knows better than anyone that while NASA works exceedingly well in space, it hasn't been working too well on the ground financially. And that's, I understand, the main thrust of your hearing here. I think we've got the right man who can get us all working together here.

That astronaut team is a national asset, and we've tried to hold on to that asset and not let the financial problems or the space station itself eat us alive. If we can balance this off, we've got to, by all means, maintain NASA at its full strength. And any way this Committee and, Chairman Wyden, anywhere I can help, I'll be glad to do it.

I'd ask consent that my statement in full be included in the record.

Senator WYDEN. Without objection, that's so ordered.

The CHAIRMAN. Thank you both.

[The prepared statement of Chairman Hollings follows:]

PREPARED STATEMENT OF HON. ERNEST F. HOLLINGS,
U.S. SENATOR FROM SOUTH CAROLINA

Let's begin by commending Senator Wyden for scheduling this hearing. It has been called to allow the Committee to conduct the appropriate oversight of NASA's operations. Presently, one of the greatest challenge facing NASA is its financial management, which has been found to be lacking and insufficient in many respects. Today's hearing will largely address this matter.

I am pleased that Administrator O'Keefe has agreed to appear before the Committee today to answer questions about the agency's financial management issues. It is well known that he was sent over to NASA with one goal in mind—to *get the agency's financial management back on track*.

I do not need to catalog the problems at NASA, but let me add my voice to the voices of the Subcommittee Chairman and others. I hope at this time next year we are not sitting here discussing the same problems. NASA needs to find a way to make its financial systems work, foremost of which include estimating costs in a more consistent and realistic manner.

The fact is that the American people are not interested in the nuts and bolts of your integrated financial management system. They want NASA to continue leading the way toward more enhanced space discoveries and exploration. But these missions cannot be achieved until NASA does the basics—which *must start with the implementation of sound financial oversight practices*.

Now, I am sure that today we will hear about several studies and recommendations that are due in the next few months. I, for one, am willing to give the agency, and more specifically, Administrator O'Keefe, appropriate time to garner the advice and recommendations necessary to make sound management decisions, and to put in place a more sufficient financial management system.

Unfortunately, far too often in this town, the word "study" is a euphemism for delay. It should be made clear that this Committee will have little patience if we are left without answers to major questions, such as what criteria are going to be used to proceed on the Space Station, as we go into the next budget cycle.

Before I go on, let me just mention the Space Station. Originally, the Station was going to cost us \$8 billion. Now the life cycle costs are expected to be \$100 billion. The stated purpose of Station is research, but the current configuration will only allow for 20 hours a week of crew time for research. Yet the Administration will continue to nickel and dime important research programs in NASA and in other science agencies because its budget cannot support them.

Finally, I want to emphasize that although there are serious, yet valid questions about NASA's management issues, as an agency and a mission, NASA is truly a national treasure. I want to thank the people of NASA—from the astronauts and engineers to technicians. The new pictures from the Hubble Space Telescope that were published last week show us that their work has meaning not just to scientists but also to average citizens. The frustration that some may detect arises out of the desire to ensure that there are no internal and administrative impediments to accomplishing America's space goals. My hope is that we can get NASA's house in order so that it can have the tools it needs to effectively carry out its mission and successfully achieve its goals.

Senator WYDEN. I thank the Chairman and thank him for this effort to proceed on the NASA authorization at this early stage. I look forward to working with the Chairman and thank you for coming.

Mr. O'KEEFE. Thank you, Chairman Hollings, I appreciate your very thoughtful comments. Pardon me.

Senator WYDEN. Today, as Chairman Hollings has noted, we begin work on the authorization bill for NASA, and I want to begin this discussion in the Subcommittee by stating clearly that I want a NASA that is the best possible investment, a NASA that pays

dividends as rich as those of the early days of the space program, when names like Apollo and Mercury leapt from the pages of mythology into the stratosphere of cutting-edge science. It's clear that in order to regain the glory of the past and fulfill its mission for the future, the agency is going to first have to address several current and pressing challenges.

NASA must first rebuild the Congress's confidence in the agency by getting control of financial management. On March 20th, the General Accounting Office reported to Congress, yet again, that the books at NASA are simply an undocumented shambles. NASA's independent auditors and the General Accounting Office cannot continue to disclaim opinions on NASA's books because not enough backup information exists to confirm or to refute financial information.

I'm especially troubled about the International Space Station. When the current design was adopted in 1993, NASA said building the station would cost \$17.4 billion, certainly no more than \$2.1 billion per year. Nearly a decade later, the agency's admitted cost for completing the space station has grown to roughly \$30 billion, almost \$5 billion more than cost caps imposed by the Congress. Continual cost overruns and failures to estimate costs with any fidelity from year to year simply must stop.

My colleagues and I are going to want to look in some detail at plans for the International Space Station. Cost overruns aside, or perhaps in light of the amount of money that's been spent, the Congress will certainly want to work with Administrator O'Keefe to set ambitious criteria for a space station to benefit scientific inquiry for future generations.

Let me make clear that these are not problems created by you, Mr. Administrator, but they are problems that must be solved on your watch. It is time to nail down the numbers once and for all. And this Subcommittee and the Senate are anxious to work with you and give you the tools that you need to get the agency's financial house in order.

The reason for draining the swamp of NASA's financial morass is more than an economic one, in my view. The agency's scientific mission depends on it. The agency has to regain financial credibility with the Congress and with the country's taxpayers. Unless the agency demonstrates fiscal responsibility, there simply won't be the funds needed for the far-reaching science of tomorrow. The Congress is not going to continually throw good money after bad. But with assurance that the boondoggles of today are behind us, I hope that NASA will find the freedom to dream for tomorrow and have the support of our nation to do it.

I want to see us recapture the vision of John F. Kennedy's commitment to putting a man on the moon by 1970. It's not enough, in my view, to endlessly circle the earth in low orbit. NASA should set the goal of putting a person on Mars and work with the Congress to set a date to do it. But the aim must be to reach Mars both safely and cost effectively or not at all. Mars is nearly 50 million miles away, and the dangerous journey there could take months. A mission to Mars is not an idea for the faint of heart or for the frivolous. Getting there is going to take daring, it'll take courage, and it'll take discipline. The discipline has to begin before

the first plan is drawn. And that's what this authorization is all about, is putting in place the discipline that's needed to do the job.

When the agency looks to the future, current scientific projects cannot be allowed to fall by the wayside either. The agency must continue to do what it does well, which is to achieve success in human and unmanned space-flight programs. As we've stressed in our hearing last fall on shuttle safety, the excellence of the shuttle program must be maintained while research continues on a next-generation space vehicle. And in this regard, I especially want to thank Senator Nelson, who hopefully will be joining us shortly, for his dedication to that task. The challenge is to keep moving forward with projects already on NASA's plate while repairing the mistakes of the past.

Administrator O'Keefe and I are on record as being in agreement that the business of the agency has to be science. In his nomination hearing 4 months ago, Mr. O'Keefe and I both noted that NASA's research supports the technological advances to drive our country's economy.

You've come, Administrator O'Keefe, to the agency to oversee a period of great transition. Two recent announcements from your agency have offered significant hope for the agency, and particularly for scientific research and innovation. The new images from the Hubble Space Telescope show that NASA research still has the potential to illuminate the universe and inspire the world. And your restart of the Teacher in Space program indicates that you're ready to inspire the future generations of scientists, discoverers, entrepreneurs, and astronauts that the country needs.

Much of the other news coming from the agency, however, has been less than inspiring. And it is incumbent on you, Mr. Administrator, and this Subcommittee to work together to tackle these issues facing the agency. In the next few months, you'll be making several recommendations regarding space station research and cost estimates and privatizing the shuttle. We're going to be looking forward to hearing those recommendations.

We will be working in a bipartisan way. Senator Allen and I, from the start of our joint efforts in this Subcommittee have made it clear that we think these issues require a significant degree of bipartisanship, and that's the way we have approached them.

And I'm pleased to recognize my friend and the ranking minority member, Senator Allen.

[The prepared statement of Senator Wyden follows:]

PREPARED STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

Today the Subcommittee on Science, Technology and Space begins working toward an authorization bill for NASA. I want to begin this discussion by stating clearly that I want a NASA that is the best possible investment—paying dividends as rich as those of the early days of the space program, when names like Apollo and Mercury leapt from the pages of mythology into the stratosphere of cutting-edge science. It is clear that in order to regain the glory of the past and fulfill its mission for the future, NASA first must address several current challenges.

To start, NASA must first rebuild the Congress's confidence in the agency by getting control of financial management. On March 20, the GAO reported to Congress again that the books at NASA are simply an undocumented shambles. NASA's independent auditors and the General Accounting Office cannot continue to disclaim opinions on NASA's books because not enough backup information exists to confirm or refute the financial information.

I am especially concerned about the International Space Station. When the current design was adopted in 1993, NASA said building the Station would cost \$17.4 billion, certainly no more than \$2.1 billion per year. Nearly a decade later, NASA has admitted that the cost of completing the Space Station has grown to roughly \$30 billion, almost \$5 billion more than cost caps imposed by the Congress. Continual cost overruns and failures to estimate costs with any fidelity from year to year have got to stop.

My colleagues and I will want to look in some detail at the plans for the International Space Station. Cost overruns aside—or perhaps in light of the amount of money that's been spent—Congress certainly wants to work with you to set ambitious criteria for a Space Station to benefit scientific inquiry for future generations.

These are not problems you created, Mr. Administrator, but they are problems you must solve. It's time to nail down the numbers once and for all. Congress is ready to work with you and give you the tools it will take to get your financial house in order.

The reason for draining the swamp of NASA's financial morass is more than economic. NASA's scientific mission depends on it, too. This agency must regain financial credibility with the Congress and with the nation's taxpayers. Unless NASA demonstrates fiscal responsibility, there is not going to be funding for the far-reaching science of tomorrow.

Congress isn't going to throw good money after bad. But with assurance that the boondoggles of today are behind us, NASA may find the freedom to dream for tomorrow—and the support of the nation to do it.

I want to recapture the vision of John F. Kennedy's commitment to putting a man on the moon by 1970. Today, it is not enough to endlessly circle the Earth in low orbit. NASA should set the goal of putting a person on Mars and work with Congress to set a date to do it. But the aim must be to reach Mars both safely and cost-effectively, or not at all.

Mars is nearly 50 million miles away, and the dangerous journey there could take months. A mission to Mars is not an idea for the faint of heart or for the frivolous. Getting there will take daring, it will take courage, and it will take discipline—and the discipline must begin before the first plan is drawn. The discipline must begin today.

While NASA looks to the future, current scientific projects cannot be allowed to fall by the wayside either. The agency must continue to do what it does well: achieve success in human and unmanned space flight programs.

As this Subcommittee stressed in its hearing last fall on shuttle safety, the excellence of the Shuttle program must be maintained while research continues on a next generation space vehicle. I want to thank my colleague from Florida, Senator Nelson, for his dedication to that task. The challenge is to keep moving forward with projects already on NASA's plate while repairing the mistakes of the past.

NASA Administrator Sean O'Keefe and I are on the record in agreement that the business of NASA is—or should be—science. In his nomination hearing four months ago, Mr. O'Keefe and I both noted that NASA's research supports the technological advances that drive our nation's economy.

Administrator O'Keefe, you came to NASA to oversee a period of great transition. Two recent announcements from your agency have offered much hope for the future of NASA and its scientific research and innovation. The new images from the Hubble space telescope show that NASA research still has the potential to illuminate the universe and inspire the world. And your restart of the "Teacher in Space" program indicates that you're ready to inspire the future generations of the scientists, discoverers, entrepreneurs, and astronauts that this nation needs.

However, much of the other news coming from NASA is less than inspiring, and it is incumbent both upon you and upon this Subcommittee to tackle the many issues facing your agency.

In the next few months you are due to make several recommendations regarding Space Station research and cost estimates and privatizing the Shuttle. This Subcommittee will look forward to hearing those recommendations.

I am hopeful that my colleagues and I can work in a bipartisan fashion with you, Mr. O'Keefe, and with the Administration to make some progress toward an authorization bill this year.

**STATEMENT OF HON. GEORGE ALLEN,
U.S. SENATOR FROM VIRGINIA**

Senator ALLEN. Thank you, Mr. Chairman, and thank you for your kind words and your leadership and for having this hearing

this morning on a very important subject. I would agree with every aspect of your comments in your opening statement. I would also, of course, thank you, Administrator Sean O'Keefe, for being here. And I think it is very important that we do work in a bipartisan way on this authorization, that we get it passed as quickly as possible.

I believe, as you do, Mr. Chairman and Administrator O'Keefe, that Americans are rightly proud of NASA and its achievements for the past 44 years. NASA has accomplished some truly impressive feats, including, of course, sending astronauts to the moon and today's International Space Station. And, of course, my young son, who is 11 years old, was absolutely amazed at the pictures from the Hubble Space Telescope of the colliding galaxies. And he was pointing out to Daddy what all these things were. So it's good to see how that is relevant to youngsters and how it gets them thinking and asking, "Well, do you think in all of that there's a planet like Earth." And those are the kind of questions that are very important and gets one to get a sense of where we are, maybe in the whole universe, in the mind of God.

The research and development at NASA has enhanced also America's leadership in a variety of ways. It's helped our national security. It's also helped our economy and the lives of Americans and people around the world. However, as you said, Mr. Chairman, we're proud of NASA's past, but this hearing is not about the past. This hearing is about discussion of NASA's future. And Administrator O'Keefe, you have a daunting mission of leading NASA's program management and their finances.

As you explore these issues, I hope you'll consider certain guiding principles. First, in my view, NASA should continue to focus on scientific excellence for the competitive leadership of America in aeronautics and space. Second, NASA has to be fiscally responsible with the taxpayers' dollars. And, finally, NASA must ensure that safety is always an essential component for all its programs.

And this morning, I would like to focus on the first "A" of NASA: aeronautics. According to the NASA aeronautics blueprint toward a bold new era in aviation—this is a short summary of it, but well produced, and it has the exact technological solutions, whether it's in revolutionary vehicles, digital aerospace, security and safety, or state-of-the-art educated work force. It's a good document. Indeed, according to this document, U.S. aviation research, "has fallen by more than 50 percent from a 25-year peak in 1987." Meanwhile, the Europeans are now investing more money in aeronautics research than is the United States. In fact, the Europeans, in a similar document, I suppose, as far as their vision or blueprint—they call it "Vision 2020"—they're striving to be the world's undisputed leader in aviation in two decades.

Now, 25 years ago, the United States had 90 percent of the market share for commercial aircraft. Twenty-five years later, today, rather than a 90-percent market share, we're at a 50-percent market share for commercial aircraft. Now, this doesn't bode well for the future of the United States aeronautics industry, or Langley, in Virginia, or the other research facilities, nor does it bode well for America's position as the technological leader in aviation. The need for air superiority in operation Enduring Freedom under-

scores the necessity for the United States to remain at the forefront in aeronautics research and development.

Moreover, after September 11, Americans are more concerned than ever about air safety. NASA research has and should continue to play an absolutely essential role in improving air safety. And even in this blueprint, there are examples of where technology, working with aviation, can make it faster, cleaner, more quiet, as well as making sure that the areas that we want to be absolutely safe can be better secured.

The National Aeronautics and Space Act of 1958, as a founding document, states that the U.S. aeronautical and space activities must be conducted to contribute materially to, "the preservation of the United States' preeminent position in aeronautics and space." More recently, NASA stated in the Aeronautics Blueprint that failure to act—and I agree with you completely—failure to act risks significant economic and social consequences. Now, given these guiding principles, many of which are either in founding documents or the current blueprint on aeronautics, I am going to be interested in hearing how NASA has determined that it is in the best interest to reduce funding for the aeronautics programs by \$58 million, or approximately 10 percent from last year.

I think—and I'll get into the questions—and I think that your method of presenting a budget is much better than just a big, glommed approach, and we'll see what the subcategories are, but I will be very interested, and I'll question you more closely on that.

But I understand, Administrator O'Keefe, that NASA has many important missions, including the International Space Station, the space shuttle, the space launch initiative, but aeronautics, in my view, needs to be elevated to a top priority, as well. And we're going to work together, I know, on this, not only in a legislative and administrative, but in a bipartisan way.

And again, thank you, Mr. Chairman. Thank you, Mr. O'Keefe.

Senator WYDEN. I thank my colleague, and he knows I'm very interested in working with you on these aeronautics issues. And the Administrator and I have discussed them, as well, and we'll be working closely with you on them.

Senator Dorgan.

**STATEMENT OF HON. BYRON L. DORGAN,
U.S. SENATOR FROM NORTH DAKOTA**

Senator DORGAN. Mr. Chairman, thank you.

Administrator O'Keefe, I want NASA to succeed, and I want to be a part of this Committee that helps it succeed. My feeling is that a society that stops exploring is one that loses its vitality and its vision, and I think NASA is one of those unique federal agencies that is an exploring agency. And we tend to judge NASA by conventional standards. But NASA is an agency whose mission pushes the envelope of new technology. And, in that, there is significant risk. But there's also the offer of a promise of great reward, and we've seen a good many things in our daily lives that come from the experimentation from NASA.

And so I really feel that we need—as the Chairman of the Subcommittee said, and the Ranking Member said—we need to have a good handle on our finances. We need to understand what we're

investing in. But I also accept that this is an agency that perhaps embraces, by its very nature, more risks than other agencies, because it is not flying in the comfort zone. You are, in almost all circumstances, finding the new edge of technology. And so the men and women of NASA, with whom I have visited over the years, have been enormously impressive to me. I think that what they do has been very substantial and very important to our country.

Mr. O'Keefe, one of the things that I've been involved in is taking the massive quantity of information that is produced by NASA's satellites and the work of NASA and, through Mission to Planet Earth—the old Mission to Planet Earth—bringing that down to make it usable information and practical information for people here in our country. And we created an Upper Midwest Aerospace Consortium, which includes universities in our part of the country—Montana, Wyoming, Idaho, South Dakota, and North Dakota. And that consortium, working with NASA, has been working to provide farmers, teachers, manufacturers, and small businesses with information that NASA has but had not previously put in a format that provides substantial benefits to people here. So we're doing that with NASA. I certainly hope that we can count on you to be involved in those efforts, because that's a more practical part of what NASA does day to day.

So, Mr. Chairman, the Farm Bill is on the floor, and I speak at 10:00 on the conference report. I'm not going to be able to stay for the entire hearing, but I did want to say to Administrator O'Keefe, there are a lot of us who very much want your agency to succeed. We want to be a partner in that success. We will work with you, as the Chairman indicated, on the financial issues, but I wish you well, and I hope that we can work together on some very important issues.

Mr. O'KEEFE. Thank you, Senator.

Senator WYDEN. Well, thank you very much for coming, Senator Dorgan, and we'll be working closely with you on it. And practical applications of the scientific dreaming really states it very well. We thank you for coming.

Senator WYDEN. Senator Burns.

**STATEMENT OF HON. CONRAD BURNS,
U.S. SENATOR FROM MONTANA**

Senator BURNS. Thank you very much. I know Mr. O'Keefe is just elated that all of these speeches have to be made. And he's sitting there, you know—and did you have a big breakfast?

[Laughter.]

Senator BURNS. My statement is very short. I did not have a prepared one. But I want to sort of bootstrap onto what my good friend from Virginia says. Number one, I don't think anybody else makes a better airplane than the United States of America, so it sounds to me we need a new sales force. That's, number one, because it all boils down to how well we sell our product and a good product.

But I want to dwell on the research. It's been my opinion for many years, ever since I joined this body and have seen the workings of Government and the way Government handles its research and development, we get into terrible turf wars about what is lo-

cated in our respective states. And so we dilute this business of research and development, where other countries concentrate and get their work done. And, of course, that's where the money is concentrated, and it looks a lot larger than ours. If you took our total dollars spent on research, I would imagine they probably are as great as any other country in the world. We just don't get the best use out of the buck. But it's like a man said, that when the founders of the country created this Government, they created it so inefficient that it could not take over the world. But nonetheless, I think we have to start looking at what the FAA does, what other agencies do in research, as far as aeronautics and aeronautical engineering does.

I am always amazed that about the only place that Boeing recruits engineers is at Montana State University, outside of the University of Washington. They do that because the basics—we have no aeronautics division. But why they do it is work ethic, number one, and, number two, is their basics are so sound that they can take those engineers and really make really good engineers both in their R&D and in their everyday workings of building airplanes.

So I think we have to take a good look at where we spend our dollars, and can we concentrate those dollars with an agency or a part of this Government that can get the biggest bang for the bucks, where they have a concentration of dollars and we make it a national priority. And I think we do because of the development of a supersonic aircraft that'll fly suborbital, our reusables that we go into space—we went through that. We were not concentrated. We really didn't put our best effort forward like we did when President Kennedy says to put a man on the moon and bring him back. That is a national priority. And I think this is just as important.

No other agency captures the imagination of young people to go into the sciences and the mathematics and physics like NASA does. You just take any kind of an astronaut or any kind of a presence of NASA in any school—in any school, even higher learning. The interest is wonderful, and we must not lose that outreach program.

But I think the Senator from Virginia has hit upon a point that we need to think about how we restructure to get the biggest bang for our buck when it comes to research, and make it a national priority. You can't tell me that the nation is not tuned into this, because they know that if we, as Americans—if we vacate the idea that we are not reaching out, pushing the envelope—and I know we put safety first, but there's areas where—you know, there's always risk in anything we do, and the American people accept that, and even the people that are in programs accept that—then we should find a way to restructure and to make it a national priority, because this is a national priority of great importance.

So I thank the Senator, not only my good friend from Oregon, but also the Senator from Virginia, because he has struck, I think, at the heart of the things that we should be looking at as policy makers. And with the directorship of Mr. O'Keefe, which is very capable and very able and very positive, I think we can do those things.

But I will tell you, once you start down this road, you'll create the damndest turf war you have ever seen in your life. But, nonetheless, we have to do those things that has to be done to get the

best for the American people in this society who expects us to do it, and they expect much from us. And I thank you for coming today.

Mr. O'KEEFE. Thank you, Senator.

Senator WYDEN. I thank the Senator from Montana, who has probably more capacity to strip this town of all the Washington gobbledygook and get right to the heart of saying it in English than anybody I know, and I thank him for coming and for his comments.

Senator WYDEN. Mr. O'Keefe, welcome. And we'll make your prepared remarks a part of the record in their entirety. And just please proceed as you wish.

STATEMENT OF SEAN O'KEEFE, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. O'KEEFE. Well, thank you, Mr. Chairman, Senators Allen and Burns, thank you all very much for your thoughtful opening commentary. I concur entirely that Senator Burns does have a capacity for getting exactly to the point without mincing any words at all.

Both of you, I think, in your opening comments, mentioned the imperative for lofty objectives and certainly, Senator Allen, in your commentary, the imperative for thinking through the technologies to achieve that. Indeed, one of the three quick points I'd like to raise this morning, just as an opening commentary, is to discuss some of the factors that we need to wrestle with, the first of which is how to establish and how to develop enabling technologies to achieve any of those kinds of goals. And that, I think, needs to be our first objective. It's a very pragmatic one, and it's one that is focused on the view that if there are technical limitations and technology limits to achieving those kinds of objectives that you've identified, then we need to overcome them. Again, to echo so many of the opening comments, certainly from Senator Dorgan, as well, of considering the exploring agency, our fundamental groundwork or basis of our entire foundation and mission and charter of NASA has always been to be entrepreneurial and to think about overcoming technical limitations and technology limits to achieve those kinds of loftier objectives.

So if there was a summary to one of the key elements of what we have attempted to put together in this year's budget program, as well as the overall focus of these first few months of my tenure, it is to emphasize the enabling technologies best represented by one, in particular, that I think is just characteristic of this particular theme. At present, our ability to launch and achieve low-earth orbit Mr. Chairman, as you've said that, in and of itself, is certainly a good portion of the challenge. But once you're there, you've got to have a set of objectives beyond—we've become really proficient at that, and we need to become more efficient at achieving that task, but right now, we're able to achieve that particular challenge in very short order, within 8 and a half minutes, to be at least 200 miles straight up in a low-earth orbit condition. After that, we move along at a pace that is roughly equivalent to what John Glenn flew at on Friendship VII 40 years ago. We have not gotten past that technology limitation of how to achieve space ex-

ploration in any way that's efficient or more contemporary, if you will, to really inform the science agenda that's necessary to do so.

So part of what you see in the budget request this year, and certainly a longer-term initiative that incorporates the next several years, is a propulsion and power-generation initiative to achieve just that goal, to increase the amount of speed, to decrease the amount of time it takes for exploration objectives, or to expand the amount of time we have on orbit at any location or any destination that we might choose.

So establishing those visionary goals of where we might want to go is certainly a laudable objective and one we really need to focus on. But in order to do that, we've got to get the means to get there, or get anywhere, in a means that is current enough to inform the agenda, the research, and the science-driven priorities, as well as actually accomplish something that will be contemporary in that regard. So your support for that particular effort, particularly as it pertains to an object to emphasize the nuclear propulsion systems efforts that we're emphasizing this year as part of the program, will be greatly appreciated to achieve that first-in-four-decades effort to get past that technology limit.

The second primary area—and, Mr. Chairman, you touched on it, I think, very appropriately and very accurately in your opening commentary—of wrestling control of the financial management questions that certainly pervade throughout the agency. The means by which we intend to do that is the rapid, aggressive implementation of an Integrated Financial Management Program (FMP) as expeditiously as I know how to do that and so have poured in an awful lot of effort to achieve that. The characteristic of this particular challenge, and clearly what has gained the attention of so many, is the International Space Station directly, and we are in the process of examining five separate, very specific issues as pertains to the International Space Station.

First and foremost, and very much echoing your opening comment, Mr. Chairman, is it will be science-driven and must be prioritized by the science which we think can only utilize that extraordinary capacity of low—or microgravity in that kind of condition in low-earth orbit, and that can inform a research agenda that gives us an opportunity for breakthrough opportunities or science discovery in the course of that particular pursuit. So we've assembled a group to look through the massive amount of effort in every single scientific discipline that has been produced over the last several years of what could be performed on station, and have asked this group of leading experts in each of their fields in the scientific communities to prioritize, to rank, what those objectives are on the basis of those two criteria, that which emphasizes the microgravity condition and that which leads to the greatest potential for breakthrough opportunities in the research agenda. I expect to see that prioritization effort completed by this time next month, and that will guide our thinking, in terms of the requirements for how we would deploy science aboard the International Space Station as expeditiously as we could possibly put that together.

At present, what we have is, again, a collection of, and a wide array of, scientific objectives, all of which are ranked as number-one priority and so, therefore, if everything's number one, it means

nothing is a high priority. So we're attempting to try to work through that with the two criteria I've discussed as the science objectives and get on with that expeditiously to organize how the efforts aboard station will be conducted.

The second major area to deal with on this front is the engineering challenges alone. We've got to remind ourselves with regularity, this is one incredible feat, to pull together a large-scale systems-integration effort of this magnitude. And to attempt to do it in earthbound condition would be challenging enough, but just to make it really interesting and exotic, we've decided to do it 250 miles straight up in space while the object that they're trying to build is moving at 18,000 miles an hour. That is no mean feat, and it's one that has to be done with great care and precision. In my judgement, the engineering efforts that are required in order to accomplish that task are paramount. And what I've developed and I think is before you is a very short chart which, by year, describes the challenge before us to achieve what is referred to as the core configuration for International Space Station. Until we get past the core configuration—the size of the crew, the dimensions of science, all the objectives we've talked about are contained until we achieve that core configuration. And so that becomes the milestone objective that I've stressed most dominantly.

Between now and February to March of 2004, there are 10 different space shuttle flights with payloads to build out the station as you see before you in each of the color codings, which describes, by year, the manner in which that's done. The catch is, in any large-scale systems integration effort like this, it requires the successful completion of each mission before the next can be accomplished. So each stage in these 10 flights between now and early 2004 must be successful and must be attained in order to build on the success of each of those efforts as we move along. It's an aggressive schedule, but it's one that we think can be attained by an average of 4 to 5 flights per year between now and the February/March time frame of 2004.

So our focus is on achieving that core configuration in order to facilitate the option to even consider what build-out or assembly may ultimately result from International Space Station. It's an aggressive schedule and one of the most central elements of this particular task, just completed last month as part of the STS-110 flight that returned after a very successful completion of that installation of the central piece of the truss, was a very, very successful enterprise that now permits us to build out, beginning, again, with the STS-111 flight coming up at the end of this month.

The third area to examine that we're focused on for station is very specifically to focus on the issue that Chairman Wyden raised, I think, quite accurately, and that is wrestling to the ground the issue of cost. In that regard, we are engaged right now in an internal cost estimate, which we expect will be completed within the next couple of months, and an independent cost estimate composed of folks who are engaged very specifically in the panel efforts that went on last fall, as you may recall, in order to develop an independent cost assessment of what's involved here.

What's in the fiscal year 2003 and 2004 projection budget at this point support the profile and the plan before you. We expect that

to be within the range of what the independent cost estimate produces by the end of this summer, but we'll certainly advise once that's completed. But the objective is to get that run to ground.

The fourth major area is to examine the international agreements as they pertain to our efforts on station. I've spent a considerable amount of time working with every international partner in order to assure that this particular configuration is understood as a means to facilitate that opportunity to look at what the ultimate configuration may look like beyond 2004, once we have achieved that central engineering and systems integration element. So I've endeavored to do that as diligently as I know how with every one of the international partners.

And, finally, to look at space shuttle operations to support this safely and in a way that is consistent with the engineering and system integration model, we've worked out schedule as well as a consolidation of all the efforts that go into supporting shuttle operations for Orbiter modifications as well as major modification efforts going on at Kennedy Space Center to assure the one-stop shopping opportunity gets done as expeditiously as we can to achieve Orbiter processing to meet this aggressive schedule to achieve core configuration by early 2004. So that's the second area, to discuss station a little bit in the context of this larger set of issues.

Finally, I just wanted to touch briefly, if you would, Mr. Chairman, on the education objectives. This is, in my judgment, and I think in the comments of so many members here this morning, an imperative that we really need to be focused on for two fundamental reasons. The first is that, indeed, when you look at the human capital circumstance across not only NASA, but among and within the aerospace community at large, we are, to put it diplomatically, a very mature work force. And as a consequence, the opportunity for succession thereafter is wanting at this stage. So our objective at this stage is to really push our efforts hard at exciting and inspiring that next generation of those who would seek to be explorers, and prepare them in math, science, technology, and engineering in a way that assures that we can continue these exploration agendas in the decades to follow.

I think Senator Allen's 11-year-old son inspired by Hubble—my 11-year-old son was equally wowed by that occasion, and we need to do more of that and make those kinds of information more available to classrooms. And that's the second reason that I think we need to focus on this. There are so many things that I've seen in this organization and this agency that are just absolutely fascinating, and yet we have difficulty translating it and making it available, principally to the generation of kids who are most likely to be inspired to pursue these efforts if it's available to them, and that's the K-12 area. There are so many college programs and university undergraduate and graduate fellowship and scholarship programs we pursue. But in my judgment, the area you really need to look at is—that inspires, Senator, your 11-year-old and mine—is those efforts to really motivate them to think in those terms.

Senator WYDEN. I only want to interrupt Administrator O'Keefe to note, for the record, that the talented and energetic Lilly Wyden, age 12, shares the enthusiasm of your progeny and Senator Allen's.

Mr. O'KEEFE. Indeed.

[Laughter.]

Senator WYDEN. I apologize for interrupting.

Mr. O'KEEFE. Not at all, sir. We must be inclusive in this all the way. I've got two older, who are 12 and 15, who were also motivated by this activity. So absolutely, there is no question. That is the age group that we really need to focus on. One of the comments I heard from General Ed Eberhart, who's the CINC of U.S. Space Command, was that he observed as how the two factors that motivate kids most are dinosaurs and space. Well, we certainly don't want to revert to the former as an institutional malady, so we definitely want to look at the latter as a means to inspire. As a consequence, there's a great opportunity to do that.

Finally, Mr. Chairman, with your indulgence, I'd like to recognize here today Kathy Koshaba, who's here with her Senn High School, from Chicago, class that she's brought here to town for a Close Up program effort, and they're here to examine what's going on, and equally inspired by the activities that I think space exploration and certainly the activities of the aeronautics as well as all dimensions of NASA provides.

So, with that, Mr. Chairman, thank you very much for your opportunity.

[The prepared statement of Mr. O'Keefe follows:]

PREPARED STATEMENT OF SEAN O'KEEFE,
ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

I appreciate the opportunity to appear before the Subcommittee today in my new capacity as NASA Administrator. My objective throughout my stewardship of this storied Agency is to ensure that the Congress and the public are fully aware of our accomplishments, our current efforts and our plans for the future. My job as Administrator is to remind everyone of what NASA does and what we are capable of doing. It's a responsibility I take very seriously. I believe we are at a crossroads in NASA's history. We have an opportunity here and now to reinvigorate the Agency's agenda and renew the entrepreneurial spirit present at NASA's beginning—a continued characteristic of American culture.

The President's FY 2003 budget proposal for NASA of \$15.1 billion reflects the Administration's commitment to NASA's core research efforts and its fundamental mandate to advance aeronautics and aerospace science and technology. This budget initiates exciting new efforts in the realms of space transportation and propulsion. It builds upon our abilities to measure and understand our home planet and the natural—and unnatural—forces that shape our environment. I believe it is a well-balanced and progressive budget that allows us to set the stage for the future. Enclosure 1 displays NASA's FY 2003 budget request.

In the 4 months since my confirmation, I have traveled across the country to visit each of our 10 Centers to meet NASA's dynamic workforce and have seen firsthand the remarkable science and technology efforts that are the underpinning of our endeavors. In this relatively short period of time, the Agency has taken a fresh look at the long-term management, resource, and technical challenges while continuing to expertly carry out highly complex day-to-day operations. Together we have charted a vision and mission that I look forward to sharing with you this morning.

My testimony today will focus on the talent and technology that is embedded in the NASA organization, the challenges we face, and, more importantly, the steps we will take as an Agency to chart a clear course for the future. We are intent on continuing the gains made over 44 years while pushing the edge of the envelope of what appears today to be impossible. NASA today is working together, as one Agency, committed to a clear vision and refined mission that will serve as the blueprint for service to America.

What NASA needs now is a roadmap to continue our work in a more efficient, collaborative manner. I first outlined this roadmap for NASA on April 12 at the Maxwell School of Citizenship and Public Affairs, Syracuse University. NASA's imperative is not only for the sake of knowledge—it is for our future and our security.

I have introduced a new strategic framework and vision for NASA. It is a blueprint for the future of exploration. It is a roadmap for achievement that we hope will improve the lives of everyone in this country and everyone on this planet.

That is a bold statement, I know. But, I am confident in saying this because the unique work that NASA does truly touches all of our lives.

This is NASA's vision for the future. Our mandate is:

- To improve life here;
- To extend life to there; and,
- To find life beyond.

This vision is much more than carefully arranged words; it frames all that we do and how we do it.

So, how do we get to that impressive picture of the future? The answer is by executing NASA's mission:

- To understand and protect our home planet;
- To explore the Universe and search for life; and,
- To inspire the next generation of explorers . . . as only NASA can.

To understand and protect our home planet, NASA develops satellites to study the Earth from space, and uses their observations to create models of the Earth system to enable prediction of climate, weather and natural hazards. We are well along in the deployment of the Earth Observing System to provide the first holistic view of the major interactions of the key components of the Earth system. On May 4, we successfully launched the Aqua mission. As its name implies, Aqua will observe Earth's water in all its phases (liquid, solid, and gas) and how it cycles through the Earth's oceans, atmosphere, and land, distributing energy in the form of weather and climate events. We believe that, working with NOAA, we can use Aqua and other EOS instruments to enable the extension of reliable weather prediction from the current 3–5 days to 7 days by the end of the decade.

In March, we launched the GRACE mission, which will map the Earth's gravity field and its variations with a precision never before accomplished—a precision that will help measure the effect of these variations on Earth's climate. GRACE data will be combined with sea surface topography data from Jason to enable more precise measurement of changes in sea level, and thus assessment of vulnerability of coastal regions to natural hazards. At the end of this calendar year, we will launch SORCE to help us understand the influences of solar variability on Earth's climate, and ICESat to measure changes in the topography and mass of Earth's ice sheets. We are operating and distributing data from the EOS missions already in orbit with the EOS Data and Information System, which delivered over 11 million data products in response to 2.3 million user requests.

NASA's contribution to security comes from increased cooperation and the sharing of imagery and unique technology with the federal agencies charged with the defense of our homeland. Aerospace innovations developed at our centers prevent civilian aircraft from being used as weapons. Improved air traffic control safety systems and engineering that will make future airplanes more efficient and environmentally sound are clear examples of our role in the changing nature of transportation and our nation's security. Hypersonics and quiet aircraft are efforts to speed transport and, in doing so, bolster the economy.

Our mission's second theme is to explore the Universe and search for life. NASA will exploit advanced technology, robotics, and will eventually use humans to explore and seek the answers and the science behind our most fundamental inquiries: How did we get here? Where are we going? Are we alone? If we are to achieve our ambitious objective of exploring the universe and the searching for life beyond our Earth, be it through flights to Mars or observing faraway planets, we must continue to learn about and overcome the technical hurdles that remain in our quest to answer our most probing questions.

NASA's recent achievements are only the beginning of the Agency's role in rewriting tomorrow's textbooks for America's children, as well as for today's astronomers and astrophysicists alike. Just last week, NASA released the first images received from the newest science instrument on the Hubble Space Telescope, the Advanced Camera for Surveys (ACS). The new ACS was part of the recent and highly successful STS-109 servicing mission, during which astronauts helped take Hubble to the next level of excellence. This new and improved camera now offers us 10 times the discovery power than the camera it replaced. With the ACS, our view into the depths of our Universe has been taken to a new level.

Later this month, we will launch the GALEX, Galaxy Evolution Explorer, which will use ultraviolet light to conduct an all-sky ultraviolet survey and detect millions of galaxies located billions of light years from our earth. Next year, we will travel further into our own solar system with the launch of the Mars Exploration Rovers and Mars Express missions. The Mars Rovers will take us beyond the success of the Mars Pathfinder mission in 1997 and allow us to analyze rock and soil samples on the Martian surface at a microscopic level. Mars Express, a mission planned by the European and Italian space agencies, will be the result of international collaborative efforts with NASA. This mission will take us another step closer to our search for evidence of past or present life on Mars. In January 2003, we will launch the last of NASA's great observatories, the Space InfraRed Telescope Facility, destined to be a cornerstone in our Astronomical Search for Origins Program and allowing us to peer into regions of space currently hidden from our view.

If we are to achieve the mission of exploring the universe and searching for life, there is much we must still learn and many technical challenges that must be conquered. Today's chemical energy rockets that have been the engine of exploration since the inception of space travel are today at the limit of what they can deliver. Using current technology, if we were to embark to explore Pluto in 2006, the earliest we could arrive there is 2014–2016; and then, upon our arrival, we would only be able to obtain meaningful research for 4–6 weeks. That is an 8–10 year travel period for 4–6 weeks of science. NASA's FY 2003 budget includes nearly \$1 billion for a nuclear systems initiative as a first step in addressing this challenge. Nuclear propulsion is a mature technology that has been used safely by the U.S. Navy since 1955. Since that time, the Navy has sailed over 120 million miles encompassing 5,000 reactor years without incident. This technology may hold the key to overcoming the time/distance challenge, and its application to space travel has great potential.

Propulsion is only *one* of the challenges facing further human exploration of space. Still unknown are the long-term effects of radiation and exposure to a microgravity environment on humans. The FY 2003 budget includes funding for a new initiative for space radiation research.

Our third mission objective is to inspire the next generation of explorers. America looks to NASA to build an unequalled scientific base of knowledge and motivate our youth to embrace math, science and engineering. While opportunities in the technology sector are expected to quadruple this decade, the pool of college students enrolled in science and engineering courses continues to decline. NASA has an obligation to the nation and its own workforce to reverse this trend.

NASA faces similar challenges with its scientific and engineering workforce. During one of my recent Center visits, I found that only 62 engineers out of a 3,000-person workforce were less than 30 years old. In fact, as an Agency, our over-60 population is three times larger than the under-30 workforce. Inspiring the next generation of explorers to enter fields of science and engineering is integral to NASA's success in reconstituting our workforce for the 21st Century challenges.

Students are only part of the education equation at NASA. Our Nation's educators are also a critical component of NASA's revitalized education focus. Teachers at all levels already possess the skills to inspire and plant the seeds necessary for this Nation to grow the next generation of science and technology leaders. NASA can best introduce itself and the science that it represents into the classroom by teaming up with educators, especially at the younger grade levels.

Inspiring future generations works in synergy with NASA's mission to protect our home planet. The U.S. Commission on National Security for the 21st Century (the Hart-Rudman Commission) concluded that advances in technology and changing economies mandate an increase in the level of technology literacy across society. It is clear that technological human capital is an essential component of our national security equation.

Our mission concludes with the statement, "as only NASA can." Our Agency is one of the nation's leading research and technology federal agencies with unique tools, capabilities and expertise that represent a national asset. The Agency contributes to America in a broad spectrum of areas. Medical technologies, aerospace innovations, spin-offs, nano-technologies, and countless commercial applications are rooted in NASA discovery. Our commitment to the American taxpayer is to continue providing a direct and very tangible means of improving life on our planet. Extending life beyond the reaches of our earth is not a process driven by any particular destination, but by science that will contribute to the social, economic, and intellectual growth of our society.

NASA provides a constant return on taxpayer dollars with each new discovery, telescope picture, launch, patent, and newly inspired child or adult. That being said, none of the ambitious plans that I have detailed for the Agency will take root if we

fail to improve the management of our resources, commit to fiscal responsibility, and establish a clear set of priorities. A clear vision and integrated mission are important foundations for NASA's future success, but success requires that we embrace a wide variety of tools to move us forward.

At NASA, and at other departments and agencies across the federal government, we are vigorously implementing the President's Management Agenda as a powerful management initiative. Each of the five items included in the Agenda applies directly to NASA.

First on the Agenda is the strategic management of human capital. As I mentioned previously, we face challenging times as we reconstitute and reshape our workforce for the 21st century. Today we have an extremely experienced workforce in terms of overall capability. The downside, however, is that almost one-third of the workforce will be eligible to retire within the next 3–5 years. We must aggressively deal with this leadership and workforce challenge. I have recently forwarded a series of legislative provisions to the Office of Management and Budget, which address this challenge head-on. These provisions will complement the Administration's Managerial Flexibility Act, and I look forward to working with the Congress to ensure that these essential tools are enacted into law.

The second element of the Agenda is competitive sourcing. We are thoroughly examining the best ways to motivate a competitive sense in all we do. By focusing on results and outcomes, we will find the most efficient means to accomplish our goals.

The third element of the Agenda is expanded electronic government. We must pay specific attention to information technology and ensure that the information technology process is integrated into Agency decision-making.

The fourth element of the Agenda is improved financial management. I am pleased to report that we are aggressively implementing our integrated financial improvement program, which is now in the third year of its implementation schedule. I have tasked the staff to explore all options to determine whether we can accelerate implementation throughout the Agency.

The fifth element of the Agenda involves budget and performance integration. We must become results-oriented and link our budgets to performance. We will breathe new life into the Government Performance and Results Act. We in NASA are spending a great deal of effort into developing metrics to measure performance.

I would now like to provide a status of two of our major programs.

International Space Station

The International Space Station (ISS) is without precedent in the history of the U.S. space program. The ISS Program has had a year of spectacular technical achievements, which include ground preparation and checkout, launch integration, and on-orbit assembly and operations. To date, the ISS program has achieved remarkable technical successes; however, it has not been equally successful in controlling cost growth. Last year, NASA projected an overrun in the amount it needed to complete the space station, as then planned, of up to \$4.8 billion. While some of that growth may be attributable to such factors as inadequate initial requirements definition, added content, late delivery, and development problems leading to cost variance, there are clearly areas of fiscal management and program control that need improvement.

The President's Budget Blueprint for FY 2002 laid the groundwork for attaining cost control and regaining credibility for the program to reach its full potential. As a result, a course of action was prescribed to get cost growth under control and restore confidence in NASA's cost management, and to achieve the science priorities for which the Nation has made a large investment. We are continuing with the reassessment and review activities that we began last year that followed the Blueprint, but did not eliminate the cost challenge. The President's FY2003 budget projections include about \$600 million of savings that NASA will realize through the implementation of identified program initiatives, and a process that continues to seek additional savings while containing the threats to further ISS cost growth. While steps taken last year were designed to contain cost growth and to gain better understanding of its source and nature, this year will be one of corrective action—putting in place the right processes, tools, management controls, and measures to improve and evaluate the ISS program.

Thanks to the efforts of the ISS Management and Cost Evaluation (IMCE) Task Force, led by Mr. Thomas Young, we are well along in effecting proper controls and regaining credibility. I have reviewed the Young team's recommendations and have endorsed them as a roadmap to improve the ISS Program management. As a result, the ISS management has already taken actions to develop implementation strategies.

The following five points are guiding our efforts at reform and revitalization of the ISS program:

1. **Research Priorities**-Establishing an integrated portfolio of science and technology priorities that maximize the benefits of space-based research within available resources. In addition to addressing the cost challenges of the ISS, we must make a renewed determination of the research goals and on-orbit capabilities that we want the ISS to achieve. Our priority should not be to simply build an ISS to a specific hardware complement and then seek research and experiments to make use of the hardware. The ISS Program should be driven by high-priority research objectives. NASA has recently established a Research Maximization and Prioritization (ReMaP) Task Force to assess how high-priority research objectives can be best met by ISS within available resources, and how the resulting research strategy might evolve, given the possibility of research-driven enhancement to the ISS beyond U.S. Core Complete.
2. **Engineering Development/Deployment**-Development of a program road map that focuses on successfully achieving a "core complete" configuration within budget. This will not be easy, but we are dedicated to making it happen. Therefore, it is imperative that Congress provide us with the requested funds so that we can meet our commitment to achieving a core Station. Should NASA demonstrate that reforms are implemented and cost credibility is regained, this will enable future decisions towards a requirements-driven "end state" that will, defined in terms of science priorities, allow an expanded research potential for us and our international partners.
3. **Cost Estimation and Analysis**-The ISS is the largest and most complex engineering development program ever pursued by the United States. Implementation of improved methodologies, tools and controls are underway and will allow us to regain credibility and improve our ability in financial forecasting and strategic planning capabilities. An independent cost review is underway to better understand our costs. These projects will also be beneficial to the Agency at large.
4. **International Partnerships**- An important challenge is maintaining the ISS international partnerships. Our partners have expressed their concerns stemming from NASA working to get the fundamentals right to achieve U.S. core complete; and then to identify options beyond U.S. core complete to realize the full potential of the ISS. Although the configuration of the ISS has been modified to meet the cost challenges we face, the fundamental purposes remain—research and international cooperation. To reaffirm NASA's strong commitment to its international partnerships, I have formed a team to meet with representatives of all our partners to understand their concerns and to work with them in the spirit of cooperation.
5. **Mission and Science Operations**-Advanced planning for Space Shuttle and ISS operations to maximize the productivity of on-orbit research and ensure the safety of real time operations.

Space Shuttle

NASA is proud of its historic record of 106 Shuttle missions and, in particular, the accomplishments of the last year in support of the ISS. Last year, seven Shuttle missions were flown with five of those missions launched during a six-month period.

This budget continues to invest in safety and supportability improvements for the Space Shuttle and increases the investment in repairing aging Shuttle infrastructure. These investments, totaling \$1.35 billion over the next five years, will ensure that the Space Shuttle can meet NASA's space transportation needs for at least the next decade. NASA seeks to implement these upgrades as quickly as possible, and is working to accelerate the availability of planned upgrades. These investments are an integral part of NASA's Integrated Space Transportation Plan (ISTP), which also includes investments in the Space Launch Initiative (SLI) for NASA's next-generation reusable space transportation system.

As recommended by the IMCE Task Force, reducing the Space Shuttle flights to four per year appears to be sufficient to meet ISS needs. However, we are reviewing this decision to determine whether any additional flights are necessary.

The President's budget also provides for the continued pursuit of Shuttle competitive sourcing. The anticipated benefits of competitive sourcing include: (1) greater flexibility to recruit and retain the skilled personnel necessary to safely operate the Shuttle; (2) avoiding potential continued cost growth for Shuttle operations by moving to a private organization that has greater flexibility to make business decisions

that increase efficiency; and, (3) significant culture change in Human Space Flight at NASA by making it a purchaser of services rather than an operator of infrastructure.

Mr. Chairman, I believe the vision, mission, programs, initiatives and budget I have described represent a strong commitment to a healthy and forward-moving NASA. I believe it is deserving of the Subcommittee's strong support and I look forward to working with the Subcommittee to achieve an appropriation that supports the President's budget request.

I have mentioned the opportunity I have had to meet the men and women of NASA, working in our installations across this land. We have a diverse and resilient workforce, and they are proud and excited about the work they are doing. They are our greatest assets and I believe our greatest hope for the future of this Agency. They have shown me their desire to be a part of the work contributing to even greater meaning in the larger dreams represented by this Agency. Their eagerness and dedication and the strength of their resolve tell me that, together with the support of Congress and this Subcommittee, we can achieve what we have set out in this budget to accomplish—and more.

Thank you.

National Aeronautics and Space Administration—Fiscal Year 2003 Estimates

[In Millions of Real Year Dollar]

	FY 2001* Op Plan Revised	FY 2002 Initial Op Plan	FY 2003 Pres Budg- et
Human Space Flight	7,153.5	6,830.1	6,130.9
International Space Station	2,127.8	1,721.7	1,492.1
Space Shuttle	3,118.8	3,272.8	3,208.0
Payload & Elv Support	90.0	91.3	87.5
Heds Investments and Support	1,247.8	1,214.5	1,178.2
Space Communications & Data Systems	521.7	482.2	117.5
Safety, Mission Assurance & Engineering	47.4	47.6	47.6
Science, Aeronautics & Technology	7,076.5	8,047.8	8,844.5
Space Science	2,606.6	2,867.1	3,414.3
Biological & Physical Research	362.2	820.0	842.3
Earth Science	1,762.2	1,625.7	1,628.4
Aerospace Technology	2,212.8	2,507.7	2,815.8
Academic Programs	132.7	227.3	143.7
Inspector General	22.9	23.7	24.6
Total Agency	14,253.2	14,901.7	15,000.0

*FY 2001 restructured to reflect two-appropriation structure

Senator WYDEN. Administrator O'Keefe, thank you for getting this debate about NASA authorization off on a thoughtful basis. And we do have some questions.

I also want to join you in welcoming the class from Senn High School. Ms. Koshaba, thank you very much for bringing all of them, they're going to get a sense of what the opportunities are in this exciting field, and we're glad the students are here.

We're going to have 10-minute rounds of questioning, I anticipate a number of Senators coming in this morning off and on, with all the markups and the like. But before we do that, I want to recognize first our friend from Florida, Senator Nelson, who, in the shuttle program and in so many areas, has just done yeoman work, I want to recognize him first for his opening statement.

STATEMENT OF HON. BILL NELSON, U.S. SENATOR FROM FLORIDA

Senator NELSON. Thank you, Mr. Chairman. Welcome, Mr. Administrator.

I think you have uttered some profound words here in your printed statement. "This is NASA's vision for the future. Our mandate is to improve life here, to extend life to there, and define life beyond." That is visionary. That is where NASA should be heading, and I compliment you. And I continue.

So how do we get to that impressive picture of the future? The answer is by executing NASA's mission. One, to understand and protect our home planet. Two, to explore the universe and search for life. And, three, to inspire the next generation of explorers, as only NASA can. Now, if we can do that, your administration, under your leadership, will be wildly successful. It has been my hope, and it has been my little prayer for you—although I have not had a conversation with you since you were here for your confirmation hearing, a lot of which Chairman Wyden had me conduct—it has been my hope and my prayer for you that you would get bit by the space bug and that you would become an extraordinary enthusiast for the space program. And as such, with your personal relationship with the Vice President, and, therefore, your entree into the White House, you would be able to marshal, under your leadership, the resources that you need to accomplish these particular things, which are extraordinary goals and very visionary goals.

Needless to say, Mr. Chairman, I get a little concerned about marshaling the resources, because we have a total agency budget in 2001 of \$14.2 billion; in present year, 2002, of \$14.9 billion; and in 2003 of \$15.0 billion. In other words, an agency budget that is not only flat—it's less than flat when you consider the calculations of inflation.

And in the course of today's discussion, what I'm going to suggest for you, realizing the political realities that you have to face with all the other agencies of Government wanting to divvy up an increasingly shrinking pie of general Government tax dollars, what we call "discretionary—non-defense discretionary funds," and that is a political battle that you face. So in the course of today's discussion, what I'm going to suggest—NASA has got to have some relief someplace. NASA can't continue operating of trying to put ten pounds of potatoes in a five-pound potato sack.

And so, as you project, over the next 5 years, what are your budgets going to do, particularly since we have costly things—like we can't scrimp on shuttle safety upgrades, that infrastructure down there at the Cape is rusting away, and you've got to attend to that, because that's a safety matter—the only place that I can see that there's relief in your budget is to convince the Department of Defense that they need to share some of the costs for SLI over the course of the next 5 years, which would be like found money to NASA if you're still operating on a \$15 billion budget.

Now, I have started to sow these seeds. It's too early. As we mark up the appropriation—the authorization bill for the armed services, of which I am a member, I am going to try and insert language in the bill that there should be a commission to study that SLI, which is the development of the technologies of the follow-on vehicle that will follow the space shuttle. Originally, this was going to be in this decade. Well, it's not anywhere close to this decade, because we've had stops and starts. And it's nowhere close to 2012. We're probably looking at keeping this space shuttle well on to-

wards 2020. Ergo, by the way, another reason that we've got to attend to the safety upgrades on the space shuttle.

And so my suggestion is—I want to get this community and the defense community to start talking about, is it not a legitimate use of DOD funds, which also has an interest in assured access to space—is it not—and DOD being relatively flush with funds, compared to NASA—is it not a reasonable point of serious consideration that a participation in SLI be not just with NASA dollars but with DOD dollars, as well, with NASA managing it?

And so thank you for the opportunity for these opening comments.

Senator WYDEN. I thank my colleague. And, as usual, you raise important and provocative issues that we're looking forward to examining those this morning and in the days ahead.

Let me beginning the questioning, Mr. Administrator, with a troubling development this morning surrounding a proliferation issue. And I'm not sure you're familiar with all of this, but I want to give you the heart of it. The press this morning is reporting, and I, "Iran, with an assist from Russia and other countries, is developing a long-range missile that would give it the ability to strike NATO countries in Europe." The story goes on to quote Administration officials saying, "We are concerned that Russian technology and expertise is helping Iran to increase the accuracy and distance of the missiles." I think certainly, as the Senate learns more, this is going to be, pretty disturbing in light of the fact that we brought the Russians into the International Space Station program to employ Russian scientists who might otherwise participate in activities that would enhance the nuclear capabilities of countries like Iran. And then you hear this morning breaking developments about how Russian scientists are helping Iran develop the capability of attacking NATO.

So I think I'd like to begin by asking you whether you can assure the Senate that our involvement with Russia and the space station program is not supporting the scientists who are out helping Iran.

Mr. O'KEEFE. Yes, sir. You know, just 10 days ago, Deputy Secretary of State Armitage and myself visited Moscow. I spent the better part of 2 days with counterparts from the Russian Space Agency, Rosaviakosmos, as well as out at Star City with our astronauts and the Russian cosmonauts who are preparing for future expedition efforts. That's where all their training activities go on, comparable to what we've conducted at Johnson. In the course of those discussions that Secretary Armitage and I have had with both Deputy Foreign Minister Trubnikov as well as, very briefly, with Foreign Minister Ivanov, the issue of Iran Non-Proliferation Act considerations was raised as part of the bilateral discussions that Secretary Armitage engaged in in advance of the President's summit meeting there later this month, early the next, in specific reference to this particular question.

I cannot confirm, of course, and don't know, the validity of this particular story. It is a matter of recognition on the part of the officials we spoke to, they're well aware of the concern, as well as redoubling their efforts to assure that the technology that is advanced is not employed for purposes like this. So what the intelligence reports may suggest on this, I'm not aware of.

As it pertains to the space community within the Rosaviakosmos and their support for this activity, to my knowledge this is not a matter they are engaged in. If anything, they are focused very clearly on the important objectives of supporting our cooperative and partnering arrangements with great conviction. So that's their strong position on that.

Senator WYDEN. You're convinced the agency is complying with the Iran Non-Proliferation Act?

Mr. O'KEEFE. I don't know that. I think it was raised by us. We certainly asserted it. They assert as how they are convinced that they can and will and have complied. But I would refer you to Secretary Armitage and the State Department folks for a more definitive foreign policy judgment on that matter. That's my impression, that that is their strongest conviction, that they think they are.

Senator WYDEN. Why don't you get back to us in writing on that one, Mr. Administrator.

Mr. O'KEEFE. Sure.

[The information referred to follows:]

MATERIAL REQUESTED FOR THE RECORD BY HON. WYDEN

Under the Iran Nonproliferation Act of 2000 (Public Law 106-178), certain functions and authorities conferred on the President under the Act have been delegated to NASA and others to the Secretary of State. The responsibility for determination regarding Russian cooperation in preventing proliferation to Iran has been delegated to the Department of State. Therefore, NASA has referred Senator Wyden's question to the Department of State.

Senator WYDEN. It is important that I know the agency is in compliance with the Iran Non-Proliferation Act——

Mr. O'KEEFE. Sure.

Senator WYDEN. I think that you've got to have all hands on deck in the executive branch on this one.

Mr. O'KEEFE. Yes, sir. Absolutely.

Senator WYDEN. Iran represents such a security threat to this country that I'd like to have you all get back to us in writing on that.

Mr. O'KEEFE. Yes, sir. That's a perfectly reasonable request, and I'll get on it immediately.

Senator WYDEN. Let's go to the questions of financial management. We received audit information March 20, and records are in shambles, they can't be audited. And I think, at this point, with PriceWaterhouseCoopers declining to offer an opinion on NASA in the last audit, and the space station budget growing by \$4.9 billion in fiscal year 2001, we've just got to get on top of this financial issue. And I know this is very troubling to you, and the reason for it is simple. It's what we've got to do in order to take the bold steps that you heard Senators talking about this morning on the science side.

You said in your written statement that the agency is aggressively implementing an integrated financial improvement program and that you're now in the third year of the implementation schedule. How is this going to improve, in your view, the agency's financial management?

Mr. O'KEEFE. Yes. Thank you for the question, Mr. Chairman. That is the number-one management priority at NASA. There is

nothing else that's higher than that. We are wrestling to the ground what it takes in order to implement the Integrated Financial Management Program as rapidly as we can possibly do so, because, until then, we're doing estimates on the back of an envelope.

Right now, there are stovepipe systems for accounting, for logistics, for inventory, for human resources, whatever. As a consequence, this is an effort to try to pull that together and implement a full cost-accounting system in which you can actually see what the cost is of conducting activities. Right now, it's a very incremental process, and it's one that is very much stovepipe, divided among those functions, which is not acceptable.

Senator WYDEN. When are the stovepipes going to go? I think that's a good characterization, of stovepipes. You don't see too many stovepipes in houses—

Mr. O'KEEFE. That's right. Exactly.

Senator WYDEN.—in this country anymore, but they seem to still be at—I guess they're all stacked up at NASA.

[Laughter.]

Senator WYDEN. When do you think you're all going to be able to get rid of them?

Mr. O'KEEFE. Well, again, the strongest objective of this whole integrated financial management program is to do just that, so that you, by making sure that the information is used for multiple discipline purposes—finance, personnel, contracting, inventory control, whatever it is—that, in turn, breaks down those individual cultures, or stovepipes, that exist that don't communicate otherwise. So that is the key to this. And, in my judgment, the faster we implement that, the better off we're going to be at achieving that task.

As you said, we're 3 years into it. If we spent every single day, in my judgment, is 1 day longer than it should be in order to get that implemented. And I've recruited the very best information-technology financial-management talent that I know how to recruit in order to wrestle this particular question to the ground as rapidly as we possibly can.

Senator WYDEN. Last year's independent audit listed a litany of deficiencies in the financial management area. What do you think are the most serious from last year's independent audit? And what's your strategy for dealing with those?

Mr. O'KEEFE. Well, I think, clearly, the two concerns that were most dominant in their reservation on the disclaimer was, first, they couldn't access the data to back up or to support the financial records. That's flat-out unacceptable. It is not anything that even resembles modern financial management process. And again, that's a lot of what this integrated financial management system is designed to conquer so that you're not running around trying to find sheaves of paper to support transactions. This becomes a very integrated system, and it's one that, again, it must be implemented in order to conquer this problem. Otherwise, we're basically supporting a 19th century approach to accounting and financial management systems for the purpose of simply documentation.

The second area that they raised is more policy-oriented. Without getting into the nuances and intrigues of the Federal Accounting Standards Board deliberations on these things, they have basically

tightened the rules and determined that the approach we must use, and that every federal agency and department must use, is a more corporate-like function of how to define expense costs versus investment-kind of appropriations, and, in the consequence of doing so, how they get differentiated. What's an investment and what's an expense is a matter accountants argument back and forth. So that has, in part, contributed to their disclaimed opinion, and one that, again, as a matter of policy, federal-wide, I think we've wrestled that question to a clearer understanding of what is required to comply. And I'm more confident on that front than I am on the former that we can achieve that rapidly.

Senator WYDEN. Cost estimation, trying to calculate costs, has always been hard, because of technology and innovative technologies become available, and I think that's well understood. But NASA seems to get special criticism for coming up with cost estimates that don't even get in the same time zone of the final costs. And there's been a lot of criticism on this question of the agency's ability to estimate costs. What steps are underway to make changes here?

Mr. O'KEEFE. Mr. Chairman, you're definitely appealing to the bean counter in me all the way on this one.

[Laughter.]

Mr. O'KEEFE. There is no question, this is, as you say, a fairly, you know, standard malady that is confronted by any agency that is looking at technology advances, but particularly so at a place like NASA, which is quintessentially a cutting-edge exploration agency, which, by definition, everything we pursue is going to have a substantial element of technology risk that will be uncertain to estimate, because it is just axiomatic within the technology community that you will see a cost on the development side that is always going to be out of whack relative to what the original estimates were. And the cost of production, for example, in computers has demonstrated itself to be lower cost than ever could have been achieved and progressively are driven down.

So as a consequence, the challenge, in my view, in technology management is on the front end of that process, establishing an estimating procedure with an independent cost estimate which we are implementing as a standard organizational approach to be re-introduced to the agency, which has been dismissed for the past decade or so and now re-instilled, for the purpose of—up front, as we establish what program objectives are and determine what those program milestones are, to also attend to it in the cost estimate before you make decisions about resource allocation. Right now, it's after the fact. Once the program gets moving, then the judgement's made on what that general estimate is, and then we reconcile it relative to the resource allocation. That's completely reversed of the manner in which it should be conducted, and that's changed.

Senator WYDEN. My time is up for this round. I'm looking forward to future hearings about NASA and authorization where we don't have to talk at the outset about this bean-counting exercise. What I'm interested in is the dreaming department. I'm interested in the kind of vision that our children are talking about, such as exploration to Mars. But there's no way we're going to get to that

place without being in a position to satisfy the financial analysts. These kinds of things are show stoppers, in terms of our ability to secure the funds that we need for the important science and to have credibility with the public. So your work in this area is especially important.

And on my next round, we're going into the exciting things that all of us came to the Senate to work on in the NASA arena. This Committee is counting on you to put NASA's financial house in order. There is a swamp, a financial morass there that needs to be drained, and it's got to be drained quickly.

And let me recognize the Senator from Virginia.

Mr. O'KEEFE. Well, thank you, Mr. Chairman, for your very accurate description of the challenge, because I, too, would love to get to the point where we can just debate—discuss the policy of the programs and so forth that support that rather than, you know, the accountability of how we achieved it. It's terribly interesting.

I'm sorry, Senator Allen. Pardon me. I was very compelled by the Chairman's commentary.

Senator ALLEN. Let me just briefly state my view, is that you're the perfect person to put in the performance standards and the metrics that are necessary as one of those three conditions that I said, as far as principles, obviously keep us in the cutting edge in research and development and advancement. Obviously, the taxpayers need a bang for their buck and need to have the confidence in it. At any rate, I believe you're certainly—your attributes in those regards, as well as your wonderful, engaging personality, are the reasons the President put you in charge of NASA.

Mr. O'KEEFE. Well, thank you, Senator. I appreciate that comment. Thank you.

Senator ALLEN. Let me first bring up something very positive about how NASA relates to some of the concerns we face and see if you would like to comment on it. Marian Blakey, of the National Transportation Safety Board, recently was thanking a NASA agency at Langley for their excellent support as far as the very worrisome crash of American Airlines 587 in Long Island. And would you care to comment on the work there and how that helps our country?

Mr. O'KEEFE. Indeed. Thank you, Senator. I appreciate the question.

Senator ALLEN. I guess something positive here, as a switch from the bean counting.

Mr. O'KEEFE. Indeed. It's a great shift. Thank you. I'm grateful to you.

Last Friday, Marion Blakey and I spent the day down at Langley Research Center, where we are conducting the forensic analytical effort, if you will, of the composite tail section of the American Airlines 587 that crashed in mid-November on Long Island. And the confidence that the National Transportation Safety Board (NTSB) has in NASA to do this diagnostic work for what is a terribly important effort to determine not only the cause of the crash itself, but also what corrective actions we can build into through the aerospace industry to prevent these kinds of challenges and problems of occurring and disasters from happening again, is an opportunity for NASA to contribute in a way that really is an immediate mani-

festation, I think, of Senator Nelson's observation, thank you, sir—of what we're trying to emphasize in the vision and mission statement. This is a protection-of-the-home-planet kind of characteristic that we really are most excited about. And the fact the NTSB has turned to the extraordinary prowess and capability of the engineers and technologists at Langley Research Center under Jerry Creedon's able leadership down there, I think it's a testimonial to their extraordinary competence and real expertise that can't be found anywhere else. We're very proud to be associated with Chairman Blakey's efforts in that regard and will support her in any way that is necessary to achieve an understanding of the outcome of the crash as well as improve the industry standards overall.

Senator ALLEN. Thank you. I'd now like to turn to the issue of the budget and authorization. And in your statement, you said you believed it was a well-balanced, progressive budget which allows us to set the stage for the future. I think it needs a bit more balance. But, nevertheless, that's part of the process. You also talked, on page 3, about the importance of improved air traffic control safety systems and engineering that will make future airplanes more efficient and environmentally sound as a clear example of NASA's role in changing the future of transportation as well as our nation's security. And you also mention in your testimony hypersonics and quiet aircraft, our efforts to speed transport and, in doing so, bolster the economy.

My questions to you here are in a context that the budget is estimated—the aeronautics spending, just in 1998, was \$1 billion. I'm talking about just the aeronautics aspect of this. And now it's been cut in half in 5 years. All of this has not come under your watch. But, nevertheless, it's continuing. First you have the blueprint as far as the future. Then you look at the details of the fiscal year 2003 budget summary estimates. In the area of aeronautics, it's really only in the area of—under the category—it says "Revolutionize Aviation." This is page SAT 4-1. But regardless, in the Aviation Safety Program, that is generally a level funding there. On the Vehicle Systems Program, there is a drop of about \$50 million. For example, the Vehicle Systems Program has been reduced from \$369 million to \$321 million. There are also items from the blueprint, such as supersonic technology—again, from this blueprint—for which NASA has not allocated any money.

So, you know, the question I have is whether or not this budget includes sufficient resources to realize the goals that are set forth in this blueprint, which seems to have great acceptance, was thoughtfully prepared, as far as the blueprint. I'd like for you to please address that for me.

Mr. O'KEEFE. Well, thank you, Senator. Indeed, the context of this, as you've described it in the overall budget, this is a sub-element, looking at revolutionizing aviation. Last year's request was \$527 million. This year's proposal, admittedly, is modest in its increase to \$541 million. But the enacted level I think is what you're looking at, which includes a series of one-time kinds of efforts that were included and projects that will not be ongoing and so, as a consequence, measuring it from the prior year. Nonetheless, your point is well taken. Whether it's a little bit down or just a little

bit up in that regard, depending on how we count here, it is not a significant increase.

The other aspect, though, I think, that's terribly important on this is in the overall aerospace technology allowance, if you will, of \$2.8 billion, which is up \$300 million in our request from the 2002 enacted level, there are opportunities, to the extent we see it and is necessary to do so and I think you're raising a compelling argument for us to examine this carefully in our operating plan, when we come back to you after the conclusion of the Congressional deliberation, I'll have to see how that sorts out. And, to be sure, that's something I'd like to continue to consult with you to see how our plan lays out relative to the objectives we've laid out in the blueprint to assure that we have complied with that, because that is our intent.

So how the math works out and ultimately the opportunities to sort that as part of the operating plan is something I'd look forward to the opportunity to enjoin on again. And assuming that the appropriation equates to something like \$2.8 billion on the aerospace technology, per the President's request, we may have an opportunity to engage on that point.

Senator ALLEN. Well, in that \$2.8 billion figure, obviously in there is—for example, where most of these increases are in the Advanced Space Transportation, in particular, the Second-Generation Reusable Launch Vehicle system, SLI. I have no problem with that. I'm just saying that's where most of the increase is. And it seems to me that in—most of the reductions are in the Vehicle Systems Program, whether it's the advanced vehicles concepts—this is getting into sub-subcategories, getting into the details, but the advanced vehicle concepts are down about \$7.6 million; breakthrough vehicle technologies are down—I'm using approximates—\$21 million; propulsion and power research, down \$25.6 million; and rotocraft research down about \$25 million. And if we're going to have this bold vision, it does seem that we're going to need to finance that. If you're prepared to be able to address some of those specifics, you can. If not, we can do it later.

Mr. O'KEEFE. Yes, sir. No, I appreciate that. There is no question there is a reallocation, certainly within the aerospace technology objectives. It focuses on reusable launch vehicle efforts, which, again, complements, in many ways, the aerospace technology issues and the aviation questions like you've raised.

But to the very specific point of how does this square with the blueprint, that's one I really do take as an earnest commitment to go back and look at, as we discussed the other day, an opportunity to examine how we come out at the end of deliberations this year and the appropriation and to look at how that operating plan may best support that blueprint objective, because to the extent that there is, you know, a deficiency there, we really are committed to that blueprint, and I want to be sure that we've supported that in a way that carries out those objectives properly. So the adjustments that you referred to, we can certainly examine it and see where we go.

Senator ALLEN. Well, I find these blueprints you reference—we talked about the blueprints you're using with the Chairman, the corporate comparability. And corporations, well-run corporations

have a strategic plan and they have goals, and whether it's market share or whatever—usually just market share and selling—

My final question, since I have 1 minute, do you see a competitive nature of things? There's nothing wrong with competition, but we are in competition with the Europeans, as far as aviation and in the future. I would not say it's just all marketing. Airbus is a fine vehicle. It is estimated that we're going to need to have a comparable level of funding to the Europeans Vision 2020, which is roughly \$1 billion a year over the next 20 years, to remain competitive. Do you agree with that approach? How do you see us competing to, if nothing else, keep our 50 percent market share, which is down from 90 percent? But how can we at least hold what we have and hopefully gain, with the help of NASA? It's not NASA alone. The private sector is important, as well.

Mr. O'KEEFE. No, no question. The competition in the aerospace industry is vigorous. There's no doubt about that. And part of our effort, as I mentioned in the opening commentary, that I think we really need to stick to our knitting on, if you will, is to look at how we develop the enabling technologies to get to that next generation or that next capability, that leap-ahead technology required. So that means looking at aero-structures, propulsion systems, power-generation capacities that may open up those kinds of opportunities and then to assist in that manner by helping to migrate that technology into commercial activity. That's our greatest contribution. That's the way I think we can be most effective at this, is to look at those kinds of technology-advance opportunities that, by their very risk, in absence of a clear return ratio for market evident, becomes our greatest opportunity to really contribute in a great way. And that's why we're there. In so many ways, again, as Senator Nelson emphasized in the mission statement, we want to look at those things that only NASA can do. And, by extension, that means if we didn't do them, they wouldn't get done. So there are so many areas that really we need to focus on that technology leap-ahead capability, that exploration of alternatives that would provide those outcomes, rather than looking at incremental improvements here or there. We really ought to be, you know, focused more on beating the technology limits of today.

Senator ALLEN. Thank you, Mr. Administrator. I appreciate it.

Mr. O'KEEFE. Well, thank you, Senator.

Senator ALLEN. I look forward to working with you.

Mr. O'KEEFE. Thank you, sir.

Senator ALLEN. Thank you, Mr. Chairman.

Senator WYDEN. I thank you my colleague. Senate schedules seem hectic, even by the normal frenzy of this place. And we're very pleased that the Senator from Texas is here. And I think, with her permission, what I'd like to do is let Senator Nelson have his 10 minutes of questions, and then we'll recognize the Senator from Texas for both an opening statement and for her 10 minutes of questions. Is that acceptable?

Senator HUTCHISON. Thank you, Mr. Chairman.

Senator WYDEN. Great. The Senator from Florida.

Senator NELSON. Thank you, Mr. Chairman. Last fall, I was down at Johnson and had dinner with my old crewmate, Franklin Chang Diaz, and I asked Franklin about his plasma rocket that he

had been developing back since the 2080's at MIT. And he said, well, he was able to have it transferred to Johnson. And so I asked if I could go and get the tour. And he took me out there to that building right next to Ellington Field, where it is. It had already been recognized in the November 2000 issue of Scientific American, the Bessemer rocket.

And I was pleased to see in your statement, on page 4, NASA's 2003 budget includes nearly \$1 billion for a nuclear systems initiatives as a first step in addressing this challenge. And you used as an example in your statement about a mission to Pluto and how much that you could speed up—I think, a plasma rocket, for example, instead of taking us 10 months to Mars, it could get us there in 39 days. Half of it would be accelerating and half of it would be decelerating, so you wouldn't have the zero-G problems.

And, as I was getting my little tour with this rocket that is pictured here in the Scientific American article, I asked Franklin how long is it before we actually start to build one of these things? And he says, "Well, this is it. This is the first test model. And from this model, we could actually develop a capability, for example, that you could then use this plasma rocket to keep boosting the space station so you could save a space shuttle mission and, therefore, a savings of cost."

Now, it's my understanding—I haven't talked to Franklin directly since that time, which was last fall, but it's my understanding, through our staff, that that little program just keeps hanging on by its fingernails in funding. And if you're requesting a billion dollars for nuclear systems initiative, does it include this Bessemer rocket, and what are your plans there?

Mr. O'KEEFE. Let me take a look, Senator. I don't know the answer to that, and I need to get more familiar with the plasma rocket. I've heard of it, been aware of it, certainly know it's at Ellington Field, but, as it stands now, the nuclear initiative is primarily an effort to develop a very mature technology that will be, again, intended for, not just, pick any destination you like, Mars, wherever—for the purpose of cutting down the amount of time to achieve that task. And again, to the extent the plasma rocket effort may complement that or may be part of that, let me take a look at that. It sounds very exciting, and I need to get more information.

Senator NELSON. I would appreciate it if you would get back to me on that.

Mr. O'KEEFE. Yes, sir, you bet.

Senator NELSON. By the way, Franklin didn't ask me to do this, but this is just exceptionally exciting stuff. And, I mean, he's been working on this since the mid 1980's. He has a Ph.D. in plasma physics.

Is there anybody on your staff that would have an update so that we can get it on the record right here?

Mr. O'KEEFE. Let me introduce Deputy Associate Administrator Bill Readdy, who is not unfamiliar to you, Senator Nelson, who is certainly, I think, familiar with the operational side of this from several missions of his own.

Mr. READDY. Good morning, sir. As you know, Franklin is preparing for his flight here as we speak. His laboratory out at Elling-

ton Field is a concept demonstrator that he has been working on for many years. And your characterization is correct, as he has a number of graduate students that are being supported and doing his research. It's still in its infancy. It's a technology demonstrator and comes, really, under the SLI banner, in terms of orbit-to-orbit transportation and is something that we're looking at very seriously.

Additionally, we're also looking at partnering with the Department of Defense on some of those issues. You may be aware that that engine that he has, the plasma engine, requires substantial electrical power and is only enabled by having some kind of nuclear power to support the electricity required. So it's interwoven. It's something that's definitely on our radar screen, though, sir.

Senator NELSON. Is it funded in the 2003 budget?

Mr. READDY. I'll have to get back to you, sir.

[The information referred to follows:]

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Over the summer of 2002, the NASA Exploration Team (NEXT) will determine the merits of continuing NASA funding for work relating to Variable Specific Impulse Magnetoplasma Rocket (VASIMR) technology by conducting a non-advocate review of the VASIMR project. The results of the review will be announced by the end of September. In parallel NASA will determine potential Department of Defense's interest in supporting the VASIMR project.

The Department of Defense components, including the Air Force, are reviewing VASIMR technology and infrastructure to determine their applicability to military in-space operational propulsion needs. NASA's Dr. Chang Diaz will continue to pursue other funding sources outside the Agency, including the private sector. There is no funding identified in NASA's FY 2003 budget for further VASIMR technology development.

Senator NELSON. Okay. I would appreciate it. And if it's not funded, I need to know that soon, because this is a technology you don't want to have suddenly stop. He had about 30 universities that were working on this in a consortium with him. And since you all have assigned him to a seventh flight, and he's obviously got to go and do that, I don't want this to be an opportunity that that research stops, and I want to see that the funding continues.

All right, well, let's talk about the shuttle-upgrade time lines. We had a hearing here. The Chairman had held it in the first week of September, and the associate administrator was one of the witnesses at the time. There was a panel of some five folks, inside and outside of NASA, and all were unanimous that we had to start moving to incorporate these safety upgrades in order to avoid the unthinkable. So I'd like you to update me on that.

I notice that, again, the funding for the shuttle is flat. And help me feel a little better about how we're going to progress so that we can keep this system flying until—I think your latest data point was something like 2020—please?

Mr. O'KEEFE. Let me just offer a couple of comments and ask Bill Readdy to elaborate on this a little bit to the amount of time he spends dedicated every single day to the safety objectives. And let me just mention, you know, three quick points.

First and foremost, I share your conviction that the safety objective is paramount. There is no higher requirement than that. As a consequence, having attended flight readiness reviews, the whole

nine yards, leading up to each flight, I think, is a critical effort and one that I've found most enlightening in terms of the effort that we're involved in every day to assure that this is paramount all the way up to launch. The last launch occurred with 11 seconds left on the window, and I was confident that if there was any reason whatsoever the launch director felt there was anything that could possibly compromise the safe flight requirements, that that would have been deferred. So, I mean, every single individual that's involved in that activity, all the way up to the last possible second, is fully empowered and expected to say, "No," to say, "Stop, defer this, cancel, delay," whatever is necessary to assure safety of flight. We are committed to that completely.

The second point I'd offer is, the only other comparable community that I've ever witnessed, seen, or been aware of that is equally zealous about the safety objective is the nuclear community, particularly the naval reactors community. And what I'm hopeful and, as a matter of fact, we'll be announcing here in the days ahead more formally, is the recruitment of a new chief engineer who comes from the naval reactors background, very specifically focused on that task, who is equally committed to the safety objectives. And that, in my judgment, is more and more of an effort to assure that we have focused on the safety aspect of this.

Last, I would offer and very specifically to your observation, Senator, that the ASAP panel, the safety group of experts that we brought in, are the most impressive collection of folks I have seen from industry backgrounds, operational backgrounds, certainly as an astronaut who is a member of that, as well, and the quality of their expertise, backgrounds, and interests in what goes on is just positively stunning. It has been a testimonial, I think, to Fred Gregory's efforts to recruit each of those individuals in the time that he's spent as an Associate Administrator for Safety and Mission Assurance. An astronaut himself, and, you may recall, he was the CAPCOM on the Challenger—so this is ingrained in his memory, every single moment of every day, and, therefore, he is committed to that task.

Having said that, I found in meeting with the ASAP panel many times privately and in public sessions, then later on in reviewing their recommendations that, while we share and are equally convinced that there are concerns we have to look—to include the prompting of Fred Gregory, the Associate Administrator for Space Flights—to examine what it will take to extend the Orbiter beyond 2012, potentially as far as 2020, so we can begin to carefully look at that assessment. What I am expecting from that panel is a more deliberate, ordered, prioritized focus on what those safety objectives and upgrades should be, because the sum and substance of their recommendation this time out is that more is required and more people are required to monitor it. And so I've asked them to become a little more specific, in terms of the prioritization set, when they convene next, which is now coming around the corner pretty quickly, so that we can get a very clear program priority set from that.

The only change that's occurred this year is an electric auxiliary power unit that was deferred because of technical challenges that we could not overcome in time to include in this coming year's budget. Beyond that, the safety objectives, the safety upgrades we

have pursued are vigorous, in my judgment, but should be more so, if need be, based on the assessment both of Fred Gregory's request, that we look at what it'll take to support the shuttle potentially beyond 2012, and this panel of experts, who I think are extremely well qualified, to give us a more systematic and specific judgment of which upgrades we should be pursuing to assure the safety record we have really labored to achieve over these past 16 years.

Senator NELSON. Could Mr. Readdy—you had indicated he would—

Mr. READDY. Well, firstly, I'd like to say that you cannot overstate the commitment of our current administrator to flight safety. Unprecedentedly, he was at a Flight Readiness Review immediately after he was sworn in as our administrator. I think the signal that that sent to the community at large was one that, all the way to the top of the agency, there is a commitment to flight safety, second to none.

Certainly in the Office of Space Flight, we live that every single day, and it's a commitment that I think he has reinforced recently with the naming of Brian O'Connor, former astronaut, as the Associate Administrator for Safety and Mission Assurance. And we look forward to working with Brian. We look forward to working with the ASAP on prioritization of upgrades for the coming years.

Senator NELSON. Mr. Chairman, I have other questions, but obviously the time is up, so we'll just defer.

Senator WYDEN. I thank my colleague. And let me recognize Senator Hutchison. I know that I inflicted a long opening statement on the Administrator, and you haven't even begun your opening statement.

So, Senator Hutchison, you may proceed both with your opening statement and any questions, as you choose.

**STATEMENT OF HON. KAY BAILEY HUTCHISON,
U.S. SENATOR FROM TEXAS**

Senator HUTCHISON. Thank you very much, Mr. Chairman, and I apologize for being late. I had another appointment, but this is very important and certainly a priority for me.

Mr. O'Keefe, I thank you for coming. This is obviously the first visit since your confirmation, and our first chance to look at your early steps. I'm pleased that you took the job as early as you could, and now I'm hoping that we can move forward.

I want to say that we cannot have a visionary, exploratory NASA if we don't fully fund it. I think you have stated that your priority is to determine where the money is best spent and to do the most that NASA can do. However, last year, I think we made a mistake in not funding the space shuttle safety upgrades and cutting the space station's funding by \$150 million. This year, the Administration requested \$250 million less than last year's appropriation for the space station.

I think that NASA must, obviously, get its house in order, but I have to state my early concerns. I have said earlier, in your confirmation, that I was very troubled by the limit of the three-person crew for the space station. With this limited crew, 80 percent of astronauts' man-hours would be taken just to operate the space station, leaving less than 20 percent for the man-hours to conduct re-

search. So I'm worried that we may have a permanent situation where we have 80 percent of our time just operating and only 20 percent for the innovative research that we must get if we're going to make this a priority for NASA.

Second, when the termination of the X-38 crew return vehicle occurred in favor of developing a new vehicle, it then triggered the thought, are we going to jeopardize safety, which I doubt. I don't think anyone would be recommending that. But then you've got a delay in the safety return vehicle, so what does that do to the timetable? We originally had a 7-person crew timetable for the end of 2006 that's now 2008. The X-38 crew return vehicle now has been cancelled. It was supposed to be operational in 2008 to coincide with the 7-person crew. Now as you proceed to do a new vehicle, I hope that the decision to have a 7-person crew by 2008 is not put off because of the crew return vehicle. Now you're looking at possibly waiting until 2012 for the new vehicle to replace the X-38. I hope that those numbers are wrong and I know that you will tell me if they are, because I think 2012 would be too long to wait for the important research that we want to get.

So I would like to ask you three questions, if I do have time. The first is the REMAP, the research maximization and prioritization study that is due out in June. It is to assess the significant research that can be performed on the space station and it's being conducted without assuming whether there would be a 3-person or 7-person crew.

If the REMAP study finds that significant research can better be accomplished with a 7-person crew, will it be your goal to expand the station to the crew size, to seek the funding, and to make it on a much shorter timetable than 2012?

Mr. O'KEEFE. Absolutely. You've touched on precisely, I think, the pacing issue that is necessary to establish, what is the requirement for any crew size. And what we've asked the REMAP, the prioritization of science panel to do, is to be very clear about what they think are the priorities that could be pursued to utilize this unique microgravity condition. If it can be conducted in a lab here on earth or in your garage or anywhere else, then it shouldn't really be qualified in this particular case.

We really look at what the rigorous environment this infrastructure provides could do for the research agenda. And then second, to also focus very specifically on what those research breakthrough opportunities might portend in each of those various scientific disciplines. They have taken that challenge on.

I'm impressed with the zeal and enthusiasm with which they have done that, the diligence that they had taken to it, both Ray Silver, the chair of that panel, from Columbia University, and from Dr. Dave Shirley from UC Berkeley, a Glenn Seaborg protege as a nuclear physicist there, have taken on this challenge and have done a remarkable job, and I fully expect they are going to answer that.

That will then inform us what that capacity should be on International Space Station based on that priority set, and then we can begin to start looking at what that will entail in terms of, based on that priority ranking, what the capacity size ought to be, how many crew are required, how many shuttle operation flights are

necessary to support it, whether Soyuz is an appropriate capacity to count on and for what period of time. All those things will then begin to, I think clarify a bit more in that process, and we will have a truly prioritized scientific agenda that's driven by that requirement. So I very much appreciate your observation on that.

Senator HUTCHISON. And if we have that priority set, then will you go back and revisit the 3 versus 7, and try to make it a priority at NASA to fully fund the research that we believe can be done from this study?

Mr. O'KEEFE. Two quick observations on that point because, I don't mean to be evasive on this; it is more that that I think it is driven by two factors. The first one is, in order to get to any configuration, any at all that we may imagine, we have to first reach the most significant milestone in this program, which is what's referred to as Node 2, which occurs in early February to March of 2004. We have 10 flights that have to be successfully accomplished between now and that time to build that space station to the core configuration. The focus I have attempted to infuse throughout the agency and indeed, with our look at International Space Station, is to get to the basics, get to the fundamentals, assure that we do that to facilitate the opportunity to have this kind of dialogue about how big that configuration ought to be.

So from an engineering standpoint, no matter what the science may tell us, or how much money we may have, independent of those two factors, if we don't meet those engineering milestones, to integrate this large scale systems integration challenge, by early 2004 we are constricted to where we are. So that is a very difficult challenge and one that I am really fixated on being sure we meet that milestone objective that then opens up the opportunity to facilitate a larger more expansive excursion of whatever configuration we may deem appropriate.

The second factor is, I think you've touched on the point very directly and I appreciate your appreciation and observation of it, is that the science objectives will then drive what that consideration is of how big that crew size needs to be to accomplish that requirement. If that number is 7, if that number is 10, whatever it is to accomplish it, we then have information that we can make some judgements about how will we build the capacity to accommodate that, what would it cost, and then we have a dialogue and debate in terms of what that should be.

And in terms of my advocacy of that, that is but one element of looking at what that prioritization set will inform us is worth the time, effort and imposition indeed, on the astronauts we've asked to engage in this, to really conduct that scientific objective. So the answer is, yes, we will certainly reexamine what that size configuration is, driven by those two major factors.

Senator HUTCHISON. Okay. Let me ask you this. You have said that you have to accomplish all of these flights before 2004. The study comes out in June. Are you looking at starting the process of prioritizing after the study in June or are you thinking of waiting until 2004 to determine what is our priority and how can we then accomplish what we need to accomplish?

Mr. O'KEEFE. As soon after that report is released, I hope to muster everybody who's got a focus on this at the agency to that very task, to begin organizing those priorities.

Senator HUTCHISON. You won't wait until 2004 to begin that process.

Mr. O'KEEFE. No. As a matter of fact, we specifically went about the business of recruiting Dr. Shannon Lucid as the new chief scientist at NASA. She's from Johnson Space Center, and certainly well known as the American with the longest record of endurance in space of 188 days when she was aboard Mir, and she is now along with Mary Kleza, the Associate Administrator for Biological and Physical Research, going to be tasked with, and taking on willingly, enthusiastically the task of taking that report from the scientific prioritization panel and making judgments about how we can now reorganize what the payload requirements are for successive flights once we have built out to core configuration. So that's going to take time and work, and they are dedicated to starting right away, as soon as that report comes in.

Senator HUTCHISON. Okay. Switch gears to the X-38. Obviously the Human Space Flight is where the X-38 was headquartered, and that was because, of course, that's where the humans are. And so now you've got apparently the new vehicle that would provide for both cargo and astronaut transportation. NASA officials have said that this is going to be done at the Space Launch Initiative program.

My question is, do you plan to have the Human Space component of that work for design and production performed at Johnson Space Center, where the humans and the research center are?

Mr. O'KEEFE. Senator, thank you. Your characterization of the X-38 decision on that is precisely right, a single mission, single purpose spacecraft that will cost us on the order of at least a billion, maybe as much as 2 to develop, to be tethered to the International Space Station, is now a design we know how to do. The question of whether we want to make that investment now at this time, given the alternative of looking at a more versatile multipurpose craft, is again, an opportunity that we can't pass up. So rather than develop a single purpose craft, we can pursue the other. I think we can do it along the same time frame.

Within the Space Launch Initiative effort, you have precisely characterized this as a series of derivatives that are based on known flight test articles that we have flown, demonstrated and know how to do. We are trying to leverage that technology with as many other partners as we possibly can throughout the federal establishment. And I think we can accomplish that task in roughly the same time parameter going on.

When we make that down select decision about what those candidates are for prototyping for Space Launch Initiative, the opportunity to answer your question precisely of where that work will be done and who will be responsible for this in-service engineering and the other design elements will be a lot clearer. Right now it is purely speculative on my part on who might win, or what design or what prototype is best.

But to be sure, absolutely, I don't want to be ambiguous about this at all.

Senator HUTCHISON. Good.

Mr. O'KEEFE. The Human Space Flight dimension of this is paramount. It has got to meet the requirements for an emergency rescue capacity despite its multipurpose taskings that may ultimately emerge from whatever prototype we select. That resident expertise, competency and understanding is deepest at Johnson Space Center. We can't move ahead without them. They are critical to this activity and we need to make sure we collaborate on that effort as widely through this agency to meet this challenge as we possibly can.

Senator HUTCHISON. Well, I would be very concerned if I thought there were going to be any devaluation of the human component that is at Johnson Space Center, and of course if you're going to have a multiservice vehicle, it must have the human transportation side, and I would hope you wouldn't try to move that and therefore take away from the strength of Johnson, where we have always had the human component headquarters.

Mr. O'KEEFE. Thank you, Senator.

Senator HUTCHISON. Is—would you—

Mr. O'KEEFE. No, I fully appreciate your point and I understand exactly what your preference is in that regard. Again, I think we really need to be—they are central.

Senator HUTCHISON. Mr. O'Keefe, I understand that you have answered that you understand. But the question is, is there anything in your mind or plans or thoughts that could devalue the human strength at Johnson Space Center?

Mr. O'KEEFE. It would be speculative on my part. I do not want to deceive you by telling you flatly that everything is going to stay the way it is today. I don't know that to be the case. As we transform this agency, to be focused, selective and do what we need to do in order to meet the agenda, the mission of what this agency is about, there is going to be change. I don't know; I am not holding anything back here; I don't know of any change to the present configuration of the Johnson Space Center or any other of the 10 centers we operate, that would impact on any of the core competencies engaged. I'm not attempting to be evasive on this, but I do not want to deceive you to tell you that there is somehow going to be an exact maintenance of the status quo for as far as the eye can see. I don't know that to be the case and I would not speculate on that point at all at this juncture.

It is a very important dimension, though. Human Space Flight is critical. We intend to emphasize it. It is central to what we do. Johnson Space Center has always been a center of core competence on that regard.

Senator WYDEN. I thank my colleague, and let me ask just a couple of additional questions if I could, Mr. O'Keefe, and I think my colleagues, I know Senator Allen has got a very hectic schedule, and Senator Hutchison, you will see us coming in and out, but be assured that Senator Allen and I are going to be working on a bipartisan basis on this bill with you, with Senator Hutchison, Senator Nelson, and all who have been very interested in this, and we're going to wrap up in a few minutes with just that objective in mind, and we will excuse our friend from Virginia at this time.

Let's talk a little bit about some of those exciting issues that are exciting our kids, and make Americans optimistic about the future

and what's ahead, and let's start by talking a bit about a manned mission to Mars. I think what I get asked even during my relative short tenure as Chairman of this Subcommittee is when we are going to see a manned mission to Mars. And I think it would be good to get your sense to the extent that you can crystal ball when that would come about, and what are some of the factors that go into what's ahead with respect to this dream that so many Americans, myself included, have with respect to Mars?

Mr. O'KEEFE. Mr. Chairman, I think there are two, at least two fundamental limitations on picking any date, time frame or means to accomplish a human space flight to Mars, or for that matter, any other destination in many respect, is two primary factors. And again, there are several others, but these are the two show stoppers in my judgment.

The first is, again, the means to get there by any speed. We have a power generation and propulsion capacity right now that is very much limited to solar electric. We are looking at a range of different technologies that may speed, advance and enhance that capacity to actually explore at a rate that would inform the resurgent and get to anywhere you want to go in a time frame that is reasonable.

The nuclear power initiative and power generation capacity initiative that we have promoted for this year is clearly the first major step in that direction, not because of its origins but because it's the most mature technology, and as we seek to develop other technologies to accomplish that task to get there in a way that informs the research agenda sooner, and that maintains more on station time for any location, Mars included, that would be an advantage.

The second limitation has a relationship to the first, and that is the effects on humans. What we are discovering on International Space Station today is that the radiation effects and so forth that have been encountered, and what it takes to live in space for long durations, and this is our first real effort at that in all of our storied history of human space flight, that what we've encountered with that question, what we've learned from the probes to Mars, certainly the Explorer missions that will be coming next year will enhance this, is that the radiation effects on human beings would be at least a factor of 3 higher than what they are in low earth orbit right now, and that's a challenge.

We're dealing with that today and we know how to work that problem, but something that's three times that, we honestly don't know. We don't know how to sort through that. So there's a range of different capacities to shield astronauts from that extensive radiation exposure, but part of it is like anything else. When you go to a doctor for an x-ray, it's also a case of extension of duration of intensity, so the shorter the amount of time that exposure occurs, the more likely—it's not just intensity, it's duration of intensity that can be accomplished by conquering that first technology challenge.

If we can meet those two problems and really address that, then the answer to your question is, let's pick a date, let's figure out when it's going to go. Because there are opportunities really then to inform in a way that may make that excursion, that expedition

possible, if it's informed by scientific judgment that says there's a reason to go there. I think there's mounting evidence to suggest to us that there might be.

Senator WYDEN. You seem to be interested in significant changes in terms of the near-term unmanned Mars exploration initiative, that's reflected in the budget. I think you really touched on that a bit in my first question, but give me a sense of how you see our unmanned missions laying the groundwork now for future human exploration.

Mr. O'KEEFE. Well, the opportunity to pursue exploration of objectives, first with robots, will provide an opportunity, I think again, to gather the information, gather the data that is necessary to determine what is the effect for human exploration. And so we are really ambitiously pushing a series of robotic exploration missions, we have two coming in 2003 and beyond that are designed for the Explorer mission there, and that will gather the information necessary and again, you know, blaze the path if you will, to ascertain precisely what the conditions would be for follow-on human space flight endeavor.

Again, that's one of the great advantages of International Space Station today, is we learn and we can determine, in addition to accomplishing the science agenda, the very first priority of Station's requirements, is we also learn a lot about what it takes for extended duration space flight and exposure, that we will need to know before we pursue any exploration. The robotic effort that we are pushing real hard and the missions that we are advancing will inform that debate even better.

Senator WYDEN. Let me ask you, and we're going to examine this some more at future hearings as well, your education agenda for NASA. I think you're very much on target in terms of where you want to take the agency. This too is an opportunity to have benefits that will ripple through our society. They will, benefit our economy in terms of making it possible to have more trained and educated leaders. It will clearly advance the science agenda of this country. I think the benefits just multiply exponentially when you look at the possibilities of what is envisaged in terms of your education agenda.

I think what I want to ask you is, how do you get there from here? I mean, here you are with an agency that's got some pretty serious, financial constraints. I've been pontificating at some length through a couple of these hearings about the financial problems documented by the General Accounting Office. And this is an ambitious undertaking that you are seeking in the education area. I personally believe that this country can't afford not to do this. We can't afford not to pass up some of these investments. But tell us how we get there from here. I mean, how do you see this all being put in place?

And I want to also announce a little bit of a bias here. When I was a young member of the House, as I say, with a full head of hair and rugged good looks, I wrote the Talented Teacher Act, which became the Christa McAuliffe Fellowship. This is something I'm very interested in and it's an area we're going to explore at future hearings.

But just, if you would, sort of walk us through your sense of how you're going to move this agency towards a very different focus, one I think is a very good one, into the education area.

Mr. O'KEEFE. Well, thank you, Mr. Chairman. I appreciate the question. And thank you for your leadership in that regard. The efforts that the Christa McAuliffe Foundation and the program involved has offered continued hope and inspiration, I think, for an entire generation of folks as a consequence of your leadership in that regard.

I think there are three ways we can really focus on the education objectives. First and foremost, the one that's been most often discussed here in recent weeks, is the reestablishment of a program that consistently will have the opportunity for an educator to be in the space flight program. The educator mission specialist program that we've announced, Barbara Morgan will be the first of which, and her mission is destined in about 18 months or so, is markedly different from where we were 16 years ago with Christa McAuliffe's program. Although interestingly, Barbara Morgan was the backup to Christa McAuliffe at that time, and so she is exceptionally devoted to this particular mission and objective, but won't be the last of the education mission specialists.

What is distinctive is, this is an opportunity to train educators through the astronaut candidate program and then ultimately the advanced training program, to perform the range of mission requirements that are necessary for any astronaut, but to view those objectives through the prism and the eyes of an educator, and therefore translate that remarkable information that they're dealing with and what they see as a means to deliver to classrooms in a way that we frankly, physicists, astronomers, marine biologists that we've had aboard spacecraft, as well as legislators, view it from an entirely different perspective. And so educators see this from a standpoint of how do I translate this into a classroom, and she in turn will be our path blazer, if you will, to looking at this through the prism of an educator, and how do we translate this to excite that generation of kids. Both Lilly and my son Kevin are both of the age bracket who will be motivated in that regard by that case.

Secondary is to look at the range of things we do around NASA right now. It's amazing. Every single center I have been to, and I have hit all 10, many several times, with the opportunity of looking at a wide range of programs that we manage and are engaged in, and every single center, all 10 of them, have these absolutely phenomenal education initiatives going on, or outreach programs, or opportunities to make what we do available to classrooms and to universities and colleges and so forth and as a consequence, to try to pull all that together and do it in a coherent way that really will focus on this objective. I would really be excited about the opportunity of pursuing in a separate discussion with you, as you have suggested, the way to lay out all the things we do right now and do it in a more focused, coordinated way that frankly doesn't take any more money, I just think it takes more focus and concentration.

Senator WYDEN. Do you all even have an inventory of everything you're doing in the education area now?

Mr. O'KEEFE. We're just beginning to get that. I mean, that was an interesting question all by itself. Going in, I mean, this was not for lack of activity throughout the agency. There's lots and lots of education outreach efforts, but it really hasn't been inventoried that carefully.

There are some very specific initiatives. Our education office within headquarters certainly looks at some very specific areas, the grants, and this is the best we've got, and I'd like to insert it for the record, but it's incomplete in terms of what's involved.

Senator WYDEN. Without objection, we will put it in the record. [The information referred to follows:]

MATERIAL REQUESTED FOR THE RECORD BY HON. WYDEN

NASA is establishing an Office of Education, headed by Dr. Adena Loston, as a new, mission-focused organization, which will aggregate NASA's education programs, management and staff. This office is currently in the process of developing an exciting new education initiative and at the same time, reviewing existing programs for alignment with the new organization's priorities. While the Administrator offered to provide a list of current education programs or grants we believe it premature at this point as such a list will not fully reflect our new focus. This review will not be completed until late FY 2003 and we would welcome the opportunity to brief the Committee at that time.

Mr. O'KEEFE. Thank you, sir. It's an education summary of what we think we have right now but frankly, with the things I've seen in the last 4 months, many aren't even discussed here, because they are just things that have kind of cropped up within the centers that are truly just tremendous outstanding opportunities to really be engaged in.

So, we have to go about a very concerted effort, I think, of conscientiously pulling together the efforts of what we're engaged in now, and then assessing where we take that for greater outreach.

The last point that I'd mention, Mr. Chairman, if you would, is to do this in concert with the Department of Education. There is a very strong math-science initiative that Secretary Paige has promoted as part of the No Child Left Behind efforts in legislation that was enacted last year, and as a consequence, really focusing on how we could do this in tandem and in a more concerted, focused way. There are a range of opportunities that the Department of Education is engaged in that Secretary Paige and I have met to talk about how we could build off the very specific programs that they have created, and lend our capacity to that particular activity as well.

So on all three of those fronts, I think we are out of the starting blocks, but more to follow in a more—

Senator WYDEN. Out of curiosity, is this something that you and Secretary Paige think that you could do using existing authority, or do you envisage areas where new federal laws would be required or things of that nature?

Mr. O'KEEFE. Based on what I know right now, what we need to do is use the existing authority we have in a more targeted way and a more focused way. To the extent that there are other authorities that may be required, I can consult with him and determine what may be necessary there, but I know of none right now that stand in our way of achieving some of the objectives we've talked about.

Senator WYDEN. We will talk some more with you about this area, because I think this is one that could really be a sort of, flagship initiative on the O’Keefe watch. Because under normal circumstances, when everybody says look, you know, the records down there are in shambles, and the General Accounting Office can’t even, begin to review them. And somebody comes and says they want to start something new under normal circumstances, people say forget it, there’s no way we’re going to let you do anything new until you clean up the problems you already have. But I think someone like yourself who does bring strong budgeting credentials could well be the kind of person who could, make a major education initiative a sort of flagship of your service, and is something I really want to be involved in. I think it’s one of the things that really makes the American people and business leaders and other stakeholders, interested again in the future of NASA. And we will be talking to you about that.

I want to recognize my friend, Senator Nelson.

Senator NELSON. Thank you, Mr. Chairman. First of all, as a follow-up on my previous comments about DOD participating in the development and research on LSI, I would like to enter for the record my question to the Department of Defense on February 12th of this year, of which Secretary Roche responded, that should be a part—

Senator WYDEN. Without objection, that will be entered into the record at this time.

[The information referred to follows:]

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. BILL NELSON
TO SECRETARY ROCHE

Common Space Functions

Question. Senator Nelson—Some in the space community caution NASA to maintain the “firewall” between military and civil space activities. This cautious approach to NASA–DoD cooperation ignores the reality of greater interagency integration with common objectives to save money and denies NASA a critical and appropriate role in supporting public safety and global security. I have argued that a national space policy that limits DoD’s role in reusable launch vehicle (RLV) development may need to be revisited to allow significant DoD contribution to the Space Launch Initiative.

What is your position on the future of cooperation with NASA for critical, common space functions such as space lift? Will you use the Shuttle to meet DoD space delivery requirements?

Answer. Secretary Roche—The USAF fully supports cooperative efforts with NASA to maximize synergy on common space functions such as spacelift. Due to national policy restrictions and overall costs, DoD has no plans to use the Shuttle for major DoD payloads. However, the DoD does use the shuttle for a variety of space experiments and small payloads. We are fully engaged with NASA planning for future launch and range capabilities. The USAF and NASA have conducted a joint review to harmonize future RLV technology efforts. Although our organizations have differing launch requirements, we see benefit in working closely with NASA in a building block approach to achieve affordable, routine, and responsive access to space. Additionally, NASA and the Air Force have formulated a Memorandum of Agreement that establishes policies, roles, and responsibilities in pursuit of advanced launch and test range technologies that are applicable to expendable & reusable launch vehicles and ballistic missile testing. In meeting the goal of a coordinated national focus on next-generation technologies, NASA and the Air Force have established the Advanced Range Technology Working Group to serve as a forum of U.S. parties who have an interest in space launch support technologies.

Senator NELSON. And since that earlier round of statement I have double checked, and it looks like that we will have the appropriate language in the markup of the Armed Services DOD authorization bill. So if this makes it all the way through this tortuous process, you will have another basis upon which to try to get these heads together.

I want to ask you about the space station. At Syracuse you gave a speech that said that from now on, NASA will be science driven. What I would like to find out is, given the fact that the way the station is configured now, it's basically for its care and feeding of the station, and to really get the science out of the station, we've got to be able to expand it so that we have a larger crew up there. How about commenting on that?

Mr. O'KEEFE. Yes, sir. Without regard specifically to the amount of science that can be conducted, again, Shannon Lucid is probably an expert that I would defer to on this matter any minute of any day. She's been there, done that, and gotten several t-shirts, and is a profound scientist as well. So she is really looking at this question of what we will do once we get the science prioritization set approved.

As it pertains to station and how much or what it should be, the first milestone that must be achieved before we can ever talk about what other configuration might be desirable is to reach the February-March 2004 Node 2 installation. All of the components, all of the modules, everything that would make any prospect of station larger than its present configuration, may only be feasible is that's successfully accomplished, and that's no mean feat.

Between now and February-March of 2004, there are 10 flights required. Every single mission must be successful in order to build on the advance of the last mission. So if there's any deficiencies, and we've got to see it as successful, and it was wildly successful on the 110 mission that just came back a few weeks back that installed the central S-0 truss, that then the entire truss system is built off of. If we can't get each of those pieces, each part of that milestone, each of those systems engineering challenges conquered, any discussion about what would it look like beyond core configuration is purely academic, notwithstanding our fondest desires or any amount of money.

Senator NELSON. But you're had extraordinary success thus far.

Mr. O'KEEFE. Yes, sir.

Senator NELSON. I mean, what you've put up is just unbelievable.

Mr. O'KEEFE. It's phenomenal.

Senator NELSON. You know, I mean we need to recognize the technological achievement of what we've got.

Mr. O'KEEFE. It is tremendous.

Senator NELSON. But the thrust of my question is, slowing down on an assembly that basically is being completed is just going to raise more costs in the future for the International Space Station, and how are you going to get to that point where you've got six or seven crew members on board so that they can do the science?

Mr. O'KEEFE. Yes, sir. Please, let me assure you, we are not slowing down the systems integration challenge at all. I have repeatedly, regularly, frequently spent time, as a matter of fact more

time than the project manager of International Space Station would like, I'm sure, at Johnson Space Center and here at headquarters working through the very specific integration challenges to reach the configuration you have on the chart in front of you.

I have asked every single time we have met, is there a more aggressive flight rate, is there a way we could integrate this system faster than what is on this chart, and the answer is no. This is the optimum engineering configuration to meet the core configuration as fast as the engineers and large-scale systems integration managers know how to do it. And they are doing, as you say, an amazing job. This is a technological marvel.

Senator NELSON. Haven't all the projects on the station beyond the core complete been put on hold?

Mr. O'KEEFE. Again, this is chicken and egg. In order to get to the next series of configuration options, you must first reach the core configuration. Anything that needs to go on now to plan for any excursion beyond core configuration, on a technical level, is being conducted. The pacing item continues to be the actual production, delivery, payload integration and launch of Node 2, and that then facilitates the centrifuge which is currently under production; habitation modules which are under design. Any number of different approaches, the ecosystems and so forth, all of which would be the follow-on endeavors that would go beyond this are all from a technical standpoint being examined. Nothing is being slowed down.

Senator NELSON. I understand. But you can't put 7 people up there unless you've got, for example, an emergency rescue vehicle that can handle 7. So when do you crank that in? You see where I'm going.

Mr. O'KEEFE. Yes, sir, I do.

Senator NELSON. I want you to be successful in having science on the station, and you said in Syracuse that NASA's future will be science driven. So how do you get from here to there on the space station?

Mr. O'KEEFE. By sticking to the basics, getting the fundamentals right, achieving each milestone and assuring that we have an opportunity to have a debate on what that configuration will look like if we can achieve all those milestones. Because I stand by that statement.

The primary requirement for International Space Station, not the only one but the primary, should be science driven. And as we had explored in several discussions here this morning, the opportunity to look at the prioritization set on what it is that will use that unbelievable gold standard micro gravity condition in a way that we can't replicate here on earth in any laboratory condition, or even with bioreactors, how do you use that. And then second, how do you look at what those research breakthrough opportunities would be, that if they wouldn't be achievable if it were not for this capability.

We want to get there as rapidly as we can to do it under a very comprehensive systems engineering model. This is an aggressive model; it's the one that is considered optimum by the program management engineers. I have been through this with them on regular occasions in an attempt to look at how could we possibly

change that configuration to maneuver that set of options to optimize that particular effort, and this is it. What you see as laid out on the schedule is the fastest we can get there according to the engineers and the systems integrators involved.

Senator NELSON. What did you say about Node 3?

Mr. O'KEEFE. Number two is the facilitation piece that makes all of the other modules and components to be installed in February to March of 2004 feasible. Node 3 becomes an opportunity if you achieve that big milestone objective.

Senator NELSON. Okay. We're going to keep visiting on this. Let me shift to something else. Basically your space shuttle budget is flat, and you've announced that you are going to have four launches, which is a reduction of launches, four in 1 year. Clearly that's going to impact the constituency of Senator Hutchison, it's going to impact the constituency of mine, because of anticipated layoffs.

Why don't you tell us what you can for the record about that?

Mr. O'KEEFE. Yes, sir. I would be pleased to provide for the record the full launch schedule and what our intentions are over the next year to 2 years to achieve this milestone objective. What you see in the budget right now are four launches, four flights, dedicated to International Space Station. What the budget also suggests is that for any other flights related to any other activity, research flights, Hubble servicing, any other number of opportunities, launch of payloads unrelated to either of these, will be reflected in the full cost accounting of those specific programs. So that's what we're transitioning to this year.

The last centrally funded or budgeted mission was the Hubble mission that just—I'm sorry, no. It will be the STS-107 mission that's going up in July, which is a research mission. Beyond that, they will all be reflected in the actual science research objectives that are listed in those programs.

So the four are dedicated to International Space Station. Others will be above that related to the number of programs that can support that activity in the full cost that's reflected in those programs directly. So, you're going to see some number greater than 4 is my confidence.

Senator NELSON. And the layoffs?

Mr. O'KEEFE. I don't know that there will be any, because again, if you're at minimum of 4 any additional flights above that for Hubble, research missions, other activities, that we will definitely see a number of flights greater than 4, and what that ultimate number will be will be driven by the number of programs involved. I don't know that there will be any layoffs, and I sure wouldn't want to quantify based on speculation of what may not occur.

Senator NELSON. Well, there are naturally, Mr. Chairman, there is some concern in the Senator's constituency and mine that the layoffs, you've got this incredible talent that is there with all of this extraordinary lengthy memory and history, and you start laying off some of that, and then realize that you've got to ramp back up, then you don't have the value of that. From a manager's standpoint, you ought to be real concerned about that.

[The information referred to follows:]

MATERIAL REQUESTED FOR THE RECORD BY HON. NELSON

A copy of the shuttle launch manifest consistent with the Agency's FY 2003 budget request is enclosed, for your information. NASA remains focused on safely completing the International Space Station assembly sequence leading to U.S. core complete in early 2004. The reduced flight rate applies only to ISS Assembly flights. Between now and US Core Complete in the February/March 2004 timeframe, NASA currently plans a total of 10 Shuttle flights, 9 of which are for ISS assembly. The flight rate after Core Complete is under review.

Current Flights Manifested

	Fiscal Year	Calendar Year
2002	6	6
2003	5	5
2004	5	5

While NASA now plans an FY 2003 Shuttle flight rate of five, we have retained the flexibility in the External Tanks budget to fly up to six Shuttle missions a year. The Space Shuttle Program can support up to six flights a year beginning in FY 2003, assuming that NASA or Commercial/DOD requestors can provide funding. The number of Shuttle missions we will fly is not constrained to four flights a year—only flights for ISS assembly are limited to four flights a year. NASA is reviewing current funded requirements and will assess augmentation of Shuttle flights that could be funded by the requesting organization (NASA enterprise/DOD/Commercial).

While the Shuttle Program budget challenges for FY 2003 have not been resolved, it would be premature to speculate on contractor layoffs at the present time.

Mr. O'KEEFE. Yes, sir. I positively am. There is no question that the most extraordinary commodity we have throughout NASA and the aerospace community are the amazing folks that are engaged in it. And as I offered a little bit earlier in the commentary and testimony, is again, as diplomatically as I can say it, we have a very mature work force. There are three times as many folks over 60 in the aerospace community specifically related to NASA as there are that are under 30. We need to fix that combination and readjust it in a way that makes opportunities not only available for younger folks moving through the process, and opportunities for professions in science, math, engineering and technology, but we need to focus on it for the very purposes you've identified. It's going to be a challenge. The actuarial tables are driving us in a direction where we need to be really fixated on this one.

Senator NELSON. Mr. Chairman, thank you for the generosity of your time. I have got to go to a meeting with the King of Jordan, if you will excuse me.

Senator WYDEN. I will.

Senator NELSON. And I would like to, since we had to terminate my earlier questioning of Mr. Bill Readdy, I would like to submit for the record additional questions on the space shuttle safety upgrades that we had talked about at length that were absolutely necessary for the future safety of the shuttle, which you and I had garnered from that hearing that we had the first week of September of 2001.

Senator WYDEN. Without objection, that will be ordered.

And I just want to tell my colleague, who has great expertise on these issues, obviously a strong constituency interest, that we will be working very closely with you and Senator Hutchison and others on the reauthorization. My hope is before too long we can have an authorization draft that we can circulate, and among the Senators on the Subcommittee, working with the Administrator, we can begin to start those discussions quickly, and we will be working very closely with you. We thank you for all your time.

Administrator O'Keefe, I thank you for your patience, you know, we've been at it two and a half hours or thereabouts, that my sense of what the challenge is all about is to get the accounting done and to think big. I think that it all really comes down to that. Obviously there's strong feelings in the United States Senate about this program, but I will just weigh in in my capacity as chair of the Subcommittee by way of saying, I think you're up to the challenge of this very big undertaking.

I mean, either piece, the bean counting exercises as we call it, and the science piece, either one of those separately would be a very big undertaking, but I think what we're learning is that the two are absolutely intertwined and that your ability to do the significant scientific initiatives that the American people want, that our kids are so excited about, means that you've got to put the financial house in order.

So, is there anything you would like to add further?

Mr. O'KEEFE. No, Mr. Chairman. I think I want to associate myself entirely with your summary on that point, and it is probably the best description of the way I have attempted to approach this really tremendous opportunity that the President has bestowed on

me in a way that I think is responsible, that focuses on the management objectives, that really looks at what those resource requirements are in the broader sense, not just financial, but also human resource dimensions, in making decisions about how you then pursue those science objectives and those opportunities that really excite us, that really inspire that next generation, the folks who will be that next group of explorers down the road.

So, I think you've summarized it exactly right, and I am most grateful, sir, for your support. Your understanding and enthusiasm for what it is we do is just absolutely indispensable, and we appreciate it very much.

Senator WYDEN. I thank you. Let's have our staffs get together and under the leadership of Chairman Hollings and Senator McCain, and with the various Senators who have such strong interest, get to work on the reauthorization and get a draft going as quickly as we can.

And with that, the Subcommittee is adjourned.

[Whereupon, the Subcommittee adjourned at 11:46 a.m.]

A P P E N D I X

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. ERNEST F. HOLLINGS TO
SEAN O'KEEFE

International Space Station Science Objectives

Question. Since basic science is so fundamental to NASA's mission, can you explain to me why under the current plan there will be only 20 hours of research per week on the International Space Station? How can 20 hours/week justify a program that so far has cost billions of dollars more than was anticipated?

Answer. The 20 hours per week figure only refers to the average duration of astronaut direct involvement with the instrumentation; it does not measure the total research time. A significant portion of the scientific investigations only requires an initial set-up and activation in order to allow long-duration acquisition of unique and valuable scientific data. For example, a 30-minute crew activity might initiate a week-long processing of a metal alloy or a 2-week long growth of biological tissue samples under computer or remote control conditions. As of June 30, 2002, the overall crew time hours logged on research are: United States 885 hours and Russia 368 hours.

A great deal of the value of on-orbit research resides in the accumulation of high-value data that can only be obtained under microgravity or space conditions. This data cannot, however, be acquired unless short-duration but crucial human input is provided at critical times. That is why, in restructuring ISS management to affect proper controls and regain credibility, we first went back to understand the research requirements that determine the capabilities needed. To meet these requirements we are looking at operational considerations that might provide additional crew time at little or no additional cost, and option paths to meet the total research requirements in the broader context of the agency's five point plan (science priorities, engineering development and deployment, cost estimating and analysis, mission and science operations, and international partner coordination) to restore confidence in the program.

NASA remains committed to a vibrant ISS Research Program, whose objectives are multi-faceted: to enable the human exploration of space; to engage in pioneering science in space leading to new discoveries that will inspire the next generation of scientists and engineers; and to provide the unique on-orbit laboratory facilities which may assist researchers to solve practical problems here on Earth.

Financial Management

Again, it is no secret that I have been exasperated with NASA over budgetary issues related to the Space Station, in particular. This is a program that was already \$10 billion over budget last year when NASA reported that completing the Station would cost nearly \$5 billion more than expected. Earlier this year, your independent auditors, Price-Waterhouse-Coopers, disclaimed an opinion on your financial condition due to lack of documentation for some of your transactions. Shortly after that, I received a report from GAO concluding that it was unable to verify your compliance with Space Station cost limits due to your lack of an integrated modern financial management system. Despite these obvious fiscal shortcomings, NASA received a "yellow light" for its financial management.

Question. How can you square what appears to be critically flawed fiscal management with OMB's scorecard on this issue?

Answer. This is a timing issue. OMB gave NASA a "yellow" score on financial management before the PricewaterhouseCoopers audit of NASA's FY 2001 financial statements was completed. After PricewaterhouseCoopers disclaimed an opinion on NASA's financial statements, OMB immediately reduced NASA's financial management score from "yellow" to "red".

Question. What is it in NASA's management systems that gave OMB reason to show even the slightest bit of optimism on this issue?

Answer. NASA recognizes its financial management problems and is taking corrective action. Under the President's Management Agenda, NASA has developed,

and is executing, a plan that will lead to a “clean” audit opinion on its FY 2002 financial statements and to the successful implementation of a single, integrated financial management system across NASA by June 2003. The successful completion of these two initiatives should enable NASA to achieve a “green” score.

Space Shuttle Privatization

Question. If NASA implements this “competitive sourcing” plan—which is really just privatization—how will this Committee be assured that the Space Shuttle will be competitive, that safety won’t be compromised, and that the taxpayers will be protected by the government recovering all of our sunk costs? What are you doing to ensure that this plan is financially sound, and why would this be any different from the NOAA experience, particularly when we are dealing with a vehicle that would be even less competitive?

Answer. NASA is aware of the lessons learned during from the LandSat privatization experience. However, there is a distinct difference between competitive sourcing and privatization. The *President’s Management Agenda* calls for the government to take greater advantage of the capabilities of the private sector by identifying current government activities that can be performed by the private sector and conducting a competition between public and private sources (“competitive sourcing”) to obtain the most efficient and economical source of services to the government. Unlike “privatization,” which presumes an outsourcing solution, competitive sourcing enables the government to strike the best balance between activities performed by civil servants and activities performed by the private sector, while protecting the interests of the taxpayers. Competitive sourcing offers the Agency greater flexibility in dealing with these issues than would strict privatization.

NASA shares an interest in all of the issues that you raised in your question. In this regard, NASA commissioned an independent study by the RAND Corporation to identify competitive sourcing alternatives available to NASA. The ground rules for this study included the issues you have identified, and the President’s FY 2003 Budget lays out the conditions under which a Space Shuttle competitive sourcing proposal from NASA would be considered. The intent of this study is to identify potential business models that might be considered for competitive sourcing and to determine the requirements and conditions necessary for each business model to be successful, along with any expected consequences of implementation. This information should enable NASA to make an informed decision on the best course of action. As we pursue competitive sourcing of Space Shuttle Operations, we will keep the Committee apprised of the approach we are taking to address these issues.

NASA’s Vision for the Future

Question. For many years NASA seemed to maintain a persistent focus on the Space Station. You have now set forth a new vision for NASA, integrating the Station into NASA’s larger mandate is to pioneer America’s future. Can you elaborate on your vision, Administrator O’Keefe? First, to the extent possible, can you fast forward 30 years setting forth specific advances to our life here on Earth and elaborate on how NASA paved the way for these improvements. Then please expound on whether our current funding priorities get us to the futuristic vision that you have set forth. What will be the outlook for NASA then?

Back in 1985, we had a National Space Commission examine some of these big picture questions for NASA. Is it time for another Space Commission?

Answer. I introduced the new vision and mission for NASA on April 12, 2002 at the Maxwell School of Citizenship & Public Affairs at Syracuse University in a speech I called “Pioneering the Future”. I’d like to include an excerpt from that speech that addresses your question:

“Let me take you on a journey to the year 2030. We have sought life’s abodes: NASA missions have mapped continents on dozens of planets circling nearby stars, some of which show signs of life-supporting atmospheres. Evidence continues to mount for other origins of life on planets within our own Solar System, as revealed by advanced generations of robotic explorers. Humans and their robotic partners assembled complex science facilities in space to unveil even more challenging cosmic questions. We understand our home: NASA’s missions revealed the complex interactions among the Earth’s major systems, vastly improving weather, climate, earthquake, and volcanic eruption forecasting—and the impact that our Sun has on our living world. We have connected the world’s citizens: NASA’s technologies have resulted in dramatic improvements in air transportation via “green” aircraft, higher-speed international travel, and innovative measures to reduce aircraft accidents and delays. We have enabled new commerce: Low Earth Orbit has become a rapid-growth economic zone, with commercial industries taking advantage of low-gravity, abundant solar energy, lower-cost access from the Earth’s surface, and a vista that

encompasses the entire planet. We share the vision and the experience: Throughout the world, students in earthbound classrooms are learning the fundamentals of physics, math, and technology as they actively participate with space travelers via “telepresence technology.” And we continue to prepare the way for humanity’s greatest adventures. It’s quite a world in 2030, and many of the improvements to life on Earth began at NASA.”

We are busy shaping our priorities for future budgets to reflect the priorities set forth in the new vision and mission statements. We are also preparing an update to the NASA strategic plan, which will build on the foundation, set forth by the vision and mission.

NASA’s Research Priorities, GPRA/Performance & Management Goals

Question. As a former OMB Deputy Director, you understand the difficulties research agencies have encountered in preparing GPRA strategic plans and performance measures for R&D programs. Can you elaborate on whether you think GPRA standards that are often quantitative in nature can be applied to the long-term research missions of the type that NASA is confronted with regularly?

Answer. The issues you raise are challenging and important, but certainly not new. This Administration has worked hard to address some of these challenges, and NASA has been working closely with OMB and OSTP in crafting an approach to measuring the effectiveness of R&D programs. On May 30, 2002, OSTP and OMB issued guidance to agencies on R&D priorities, including guidance on R&D investment criteria of relevance, quality and performance. Additional guidance was provided from OMB to agencies on July 16, 2002 on the planned use of a program assessment rating tool (PART) for evaluation of programs in the FY 2004 budget. One of the PARTs is specifically for R&D programs. I believe that the guidelines and tools that the Administration is developing will greatly improve how R&D program performance is measured both for NASA and across all agencies.

Security

In November of 2001, NASA’s Inspector General released an audit titled “Approvals for Accessing Information Technology Systems.” The audit found that the two NASA Centers investigated “did not complete required security investigations for all personnel who accessed sensitive IT systems.” In fact, at one Center, the audit “found that the Center had completed security investigations for only 17 employees [out of a] sample of 100 contractor employees with access to sensitive IT systems. Of the 83 employees without the required security investigations, the Center did not initiate the investigative process for 27 employees and only partially completed the security investigations for 56 employees.”

Question. In light of the tragedies of September 11th, I am deeply disturbed to hear that NASA puts so little effort into security. Has NASA taken measures to correct this specific problem? If so, please describe those measures and others taken to assure that only approved individuals have access to sensitive IT systems?

Answer. Just prior to September 11, 2001, NASA embarked on an aggressive restructuring and enhancement of the agency-wide security program. In light of this, and as accelerated by the events of September 11th, weaknesses and vulnerabilities within the agency were identified and are being corrected. Requirements for security checks as they pertain to IT access were already in place though not properly followed 100 percent of the time. This also has been addressed at all appropriate levels.

NASA is currently re-writing its IT Security policies and implementing effective and practical IT security measures to protect and back-up critical data while continuing the productive exchange of information in furtherance of its scientific missions.

NASA management concurred with the recommendations provided in the Inspector General’s audit report and has taken steps to correct the problems the audit identified. Center Management at both of the Centers cited in the Inspector General’s audit have reminded owners of sensitive systems of their responsibility to have the necessary screening performed. Glenn Research Center Management now carries out background screening for all system users requiring such screening, and Marshall Space Flight Center Management has put a system in place to fund and perform the required screenings in FY 2003.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN MCCAIN TO
SEAN O'KEEFE

Question. Can NASA tell this Subcommittee the status of the Strategic Resources Review? When will Congress be able to view the results of this SRR? Will any parts of the SRR be implemented before Congress has a chance to provide feedback?

Answer. The Strategic Resources Review (SRR) was a broad-based review of NASA's processes and activities at Headquarters and all ten operating locations. The implementation of the SRR study meant reviewing at a very detailed level such functions or activities as machine fabrication shops, testing capabilities, building maintenance & repair, economical contract ordering, centralized business services, and the enhancement of technology transfer. These are only a few examples of the many activities NASA reviewed to exploit opportunities for improved economy and efficiency, and to improve NASA's focus and performance on the things that really count—the objectives of our missions on Earth and in space.

The SRR review activities, as separate from the budget planning process, are completed. Those activities that have been selected for implementation will be executed by Center Directors under the leadership of NASA's Enterprise Associate Administrators, and will be brought forward as a part of the normal budget development process within NASA. Items with cost impacts will be prioritized in the context of NASA's overall program budget priorities. On August 20, 2002, NASA transmitted the final report on the Agency's SRR to the Congress. NASA will continue to explore opportunities for improvement consistent with the President's Management Agenda.

Question. How many candidates do you currently have in the astronaut program? Do you expect any changes to that number given the reduced flight rate in the next few years for the Shuttle?

Answer. There are approximately 120 astronauts available for flight assignment, which includes 17 members of the 2000 class. The number will reduce over the next few years due to attrition. There are no plans for a new astronaut class prior to 2004.

Question. You mentioned that an independent cost review of the Space Station is underway. Is that a review of the total life cycle costs or just the development costs?

Answer. Last October, NASA chartered two separate cost estimating teams in response to the ISS Management and Cost Evaluation (IMCE) Task Force finding that the Agency had not accomplished a rigorous estimate of station life-cycle costs. The Systems Management Office at the Johnson Space Center led an internal NASA cost estimating team, and an external team was led by the Cost Analysis Improvement Group (CAIG) of the Office of the Secretary of Defense. Both teams were supported by proven cost estimating professionals. Each team provided a separate life-cycle cost estimate, complete with a risk analysis, and defined the possible cost range for the ISS within reasonable confidence levels. These reviews have provided an important input into future Station budget planning.

Question. What is the current total life cycle cost estimate for the International Space Station?

Answer. NASA developed an ISS cost assessment requirements document (CARD) that served as the basis for the two independent life-cycle cost estimates described above. The independent cost estimates were completed in August and NASA will be submitting a report of these findings to the Committee shortly.

Question. What is your strategic plan for Wallops Flight Facility, does it include testing of manned space flight technology and unmanned logistics support for the International Space Station?

Answer. The Conference Report 107-272 accompanying the FY 2002 VA-HUD and Independent Agencies Appropriations Act (Public Law 107-73) directed NASA to update the Agency's strategic plan for the future of the Wallops Flight Facility (WFF). This report is completing internal Agency coordination and should be made available for your review in late fall.

Question. In your answers to the Committee in December 2002 and in many public addresses and interviews, you have placed an emphasis on the importance of focusing on NASA's ability to "effectively and efficiently meet its current challenges." Do you believe that it is also important to establish a strategy for NASA's future, so that early-stage programs, such as the Space Launch Initiative, are fully integrated into future NASA space exploration efforts?

Answer. Yes, it is fundamental to sound management to have a strategy for the future, and to ensure that our current decisions are not only consistent with but also integral to that strategic context. Our new vision and mission statements provide the foundation of our strategy for the future, and we are beginning the process

of updating our strategic plan. I should point out that effectively and efficiently meeting our current challenges is one of the most important things we can do to ensure our future. We must earn the confidence of our stakeholders and the public that we can deliver on what we commit to, and meeting our current challenges is paramount to that.

Question. As required by the NASA Authorization Act of 2000, the General Accounting Office (GAO) is required to verify NASA's accounting for the space station and shuttle support cost limitations. In an April 10, 2002, letter to Congress, the GAO reported that it remains "unable to verify the amounts NASA reported to Congress in its fiscal year 2002 and 2003 budgets and will not be able to independently verify amounts reported in the future, either in total or for individual years." The letter reported that NASA's 10 centers "operate with decentralized, nonintegrated systems and with policies, procedures, and practices that are unique to each center." Furthermore, "only 5 of its 10 centers are able to provide complete, detailed support for amounts obligated during fiscal years 1994 through 2001"

What actions do you intend to take to ensure that all 10 centers use the same policies, procedures, and practices as you implement NASA's new integrated financial management system?

Answer. One of the key principles upon which the IFM Program was established is the use of an Agency-wide Process Team. These Process Teams include functional experts from across the Centers. The Process Teams are the cornerstone of the IFMP Project teams. These functional experts develop standard Agency requirements and business processes upon which the system implementation is based. During the design phase of each project, the full time Process Team membership is augmented with Extended Team member representation from the various NASA Centers. The purpose of this augmentation is to provide additional validation of the core design team's efforts but more importantly is to provide additional exposure and education to the Centers.

Each IFMP Project defines the implementation methodology to be followed by the NASA Centers. In addition, each IFMP Project provides guidance, tools, and products to guide the Centers through their implementation efforts. For the Core Financial Project, an Agency Rollout Kickoff Meeting was held at the end of October where detailed briefings were given explaining the implementation tasks to be completed by the Centers; Center resources required; recommended project team structures; tools, products, and contractor support to be provided by the Project; and high level timelines for the implementation windows. As each Center's implementation begins, the Core Financial Project conducts a refresher briefing from the Rollout Kickoff Meeting and lands a team of implementation experts at each Center to support the implementation. At the end of a scope definition phase, a readiness review is conducted by the Project to ensure that the Center has the proper resources, facilities, and governance structures in place to be successful.

In addition to the Project-provided implementation tools and support, the IFM Program Office has established a Program Change Management initiative to help the Centers address transformational change. Through the Program Change Management effort, each Center has established an Implementation Support Team (IST), which provides a pool of knowledgeable change management experts to support each project implementation and to coordinate Center impacts across the various IFMP Projects.

Through the use of experienced implementation contractors and established implementation methodologies and tools, the IFM Program has provided the infrastructure necessary to support a successful deployment across the Agency. One of the greatest challenges that we face is the magnitude of the implementation effort and the impact to an administrative workforce, which has been downsized by 25–35 percent since 1993. Current Center systems are extremely antiquated and inefficient so the desire/need to implement new technology is firmly in place. Administrator O'Keefe has clearly affirmed the importance of the IFM Program, its goals and objectives. Mr. O'Keefe has acknowledged the vital link between NASA's implementation of the IFM Program and our fulfillment of the President's Management Agenda. Mr. O'Keefe has identified the IFM Program as the most important initiative that NASA has underway.

Question. How do you respond to this GAO report?

Answer. While recognizing weaknesses in NASA's financial management, GAO did not make any recommendations in their report. GAO recognized the actions the Agency is taking to implement an integrated financial management (IFM) system to resolve the issues identified in their report.

Implementation of the Agency's core accounting module will provide the detailed data required to support an audit in a timely manner. NASA is taking actions to

restore confidence in the space station program through improvements in its program and financial management.

After Safety, the Administrator has made successful and accurate implementation of the agency-wide IFM system the Agency's highest priority. Mr. O'Keefe has hired a Program Executive Officer responsible for financial management who reports directly to him. The Administrator has also directed a refocus of Field Center's Chief Financial Office structure to include financial analysis and has accelerated the implementation of the IFM system.

Question. Is the GAO assessment correct in your opinion?

Answer. GAO's assessment was accurate at the time the audit was performed. NASA has made improvements since that time.

Question. You mentioned in your statement that the number of employees over 60 is three times larger than the under 30 employees. What are your plans for addressing this shortfall?

Answer. Last year NASA conducted the National Recruitment Initiative that identified specific concepts and tools that needed to be developed to enable NASA to attract and compete for recent college graduates. Three of these currently being developed are:

- Using our grants and scholarships to identify the best and brightest college graduates. Over 100 colleges and universities receive scholarship and grant money. By leveraging our contacts with principal investigators assigned to these scholarships and grants we hope to be able to capture the best talent.
- Strengthening our NASA employer branding and updating our Student Website to appeal to the students of today. Among the information that we plan to provide to students will include entry-level and cooperative education opportunities in NASA.
- Developing interactive recruitment tools, such as a recruitment CD ROM card, to enhance NASA's image as an employer of choice.

This fiscal year Centers who are positioned to do a significant amount of hiring, defined as 50 or more positions, are targeting approximately 35 percent of their recruitment towards hiring recent college graduates. This will help us to close the age gap and posture us to continue to have the experience we need to complete mission-critical work.

As we have said, we face challenging times as we reconstitute and reshape our workforce for the 21st century. Today we have an extremely experienced workforce in terms of overall capability. The downside, however, is that almost one-third of the workforce will be eligible to retire within the next 3–5 years. We must aggressively deal with this leadership and workforce challenge. To help us address this challenge head-on, we recently forwarded a series of legislative provisions. These provisions will complement the Administration's Managerial Flexibility Act, and we look forward to working with the Congress to ensure that these essential tools are enacted into law.

Question. For recent college graduates, what program areas within NASA will be hiring in the next 3 years?

Answer. NASA anticipates the need to hire recent college graduates with degrees in Biology, Astrobiology, and Biochemistry; Nanotechnology; Systems Engineering; Mechanical, Aerospace, Electrical and Computer Engineering; Chemistry; Information Technology and Earth Sciences.

Question. In the NASA Authorization Act of 2000, NASA was required to submit a plan to establish a non-government organization (NGO) to be responsible for the research utilization and commercialization activities on the Space Station. This plan was due September 30 of last year. The Commerce Committee was told the plan would be available in February 2002. The latest we have heard is that the plan will not be available until September of this year. We are also concerned about whether this plan would also include the commercialization activities. The call for the plan was based on recommendations from the National Academy of Science and the need to get these activities started as soon as possible during the assembly phase.

Answer. To respond to the Congressional direction for a report on management of ISS science, NASA is taking a comprehensive look at research priorities and Agency process and functions.

Question. Given the delay in finalizing the plan, do you feel that this NGO concept can still be effective given the previous recommendations from the Academy of Science on timeliness?

Answer. The Biological and Physical Research Maximization and Prioritization (ReMaP) Task Force has performed an independent review and assessment of research productivity and priorities for the entire Office of Biological and Physical Research (OBPR) scientific, technological and commercial portfolio.

A recently established ISS Utilization Management Concept Development Team is undertaking a detailed examination of Agency processes and functions for ISS utilization, including an examination of various options, including an NGO, for management of ISS research utilization.

NASA will use the products of these two efforts in the formulation of its FY 2004 budget.

Question. Can you highlight any current commercialization activities concerning the Space Station?

Answer. NASA is participating in a Multilateral Commercialization Group composed of representatives from each of the international partners. The group is making progress toward establishing Recommended Guidelines for ISS Commercial Activities, which are consistent with U.S. policy, while preserving the autonomy of each partner. As these guidelines are completed and applied, we anticipate commercial activity will gradually expand.

NASA has entered into a commercial flight agreement with StelSys, Inc., a Maryland biotechnology company that was organized to develop commercial applications of NASA's bioreactor technology. In furtherance of its industrial research, StelSys desires to use the ISS platform to grow human liver cells in microgravity. In the future, should the experiment be successful, and StelSys begins to use cells grown on the ISS to support ground-based commercial applications, NASA would expect to obtain fees from this company.

NASA remains committed to meeting "the priority goal of economic development of Earth orbital space," as stated in the 1998 Commercial Space Act. The Agency believes that market-based approaches like StelSys are important for maintaining a balanced ISS utilization program.

Question. According to a recent report in Aviation Week (May 6, 2002 edition) article, attracting and retaining the next generation of aerospace professionals is now a top-priority concern for the U.S. and Europe. It was further stated that a new set of NASA strategic goals will include a bolstered education program to address the issue. Can you comment on these statements and the fact the Academic Programs account at NASA received a decrease in the budget request?

Answer. NASA shares the Senator's and others' concerns about attracting and retaining the next generation of aerospace professionals. NASA's future missions, as well as the Nation's economic and national security are dependent upon a steady stream of well-educated students, especially in the areas of mathematics, science and technology.

NASA's FY 2003 request for Academic Programs is \$143.7 million. This request has two components—base funding for the Education Program (\$61.6 million) and the Minority University Research and Education Program (\$82.1 million). The FY 2002 budget of \$227.3 million included funding for a number of congressionally directed programs. The FY 2003 request maintains our core program, but does not include continuing funding for Congressional interest items, thus the perceived decrease in the budget request.

These future investments, combined with the Congress' and Administrations' previous support, have built a remarkable foundation for the Agency's education programs. However, in order to meet the challenges facing the Nation, this foundation is in need of expansion—not by the addition of more dollars, but rather through closer coordination within the Agency, as well as with our education partners such as the Department of Education, National Science Foundation, and other public and private sector stakeholders.

As you know, education has been made one of the core missions of the Agency: to inspire the next generation of explorers, as only NASA can. Since its inception more than forty years ago, NASA has worked to share its findings and missions with the educators and the students who wanted to know more about the world and universe that surrounds them. The resulting programs and initiatives have targeted our Nation's students, teachers, and faculty at all levels. The challenge before us today is to extend the reach of our education efforts even further.

To that end, NASA chartered an internal "tiger team" to review the current education program and make recommendations for an expanded education program designed to meet the Agency's mission. A transition team is currently at work implementing the tiger team's recommendations and the new NASA education office is expected to be in place early in the new fiscal year. The priorities of this new office will be as follows:

- Motivating K–16+ students to pursue careers in science, math, and engineering . . . as only NASA can
- Providing educators with unique teaching tools and compelling teaching experiences . . . as only NASA can
- Seeking to ensure that we are investing the taxpayers' resources wisely
- Engaging minority and underrepresented students, educators, and researchers in NASA's education program

More information about NASA's vision for our Education Program can be found in the NASA Administrator's June 19, 2002 statement before the Subcommittee on Science, Technology and Space, Committee on Commerce, Science, and Transportation

Question. You have mentioned that your third mission objective is to inspire the next generation of explorers. You further indicated in your written statement that the pool of college students enrolled in science and engineering courses continues to decline. The Washington Post (5/7/2000 edition) recently reported that NASA settled a class action discrimination complaint by black engineers who helped design and build the Hubble Space Telescope. How do you plan to ensure this type of discrimination does not happen again at Goddard Space Flight Center or any other part of NASA?

Clarification

The Goddard class action suit did not result in a finding of discrimination. Neither the EEOC nor any court has addressed, much less ruled upon the merits of this case. Instead, the parties entered into a Settlement Agreement.

Answer. The Class action settlement was based upon a claim of disparate impact. In other words, the Class alleged that there was systemic discrimination on the part of a protected group by the administration of a policy or practice.

Top management from each NASA Center and HQ has been briefed several times regarding the issue of disparate impact. They have been asked to review their personnel policies, look for similar disparate impact situations and address them immediately.

NASA is committed to ensuring that equal opportunity is afforded all employees and applicants and that minorities, women and individuals with disabilities are fully integrated into all occupational categories and grade levels and are in the pool of outstanding talent from which candidates for advancement are selected.

Question. What are the long-term effects from this settlement on NASA's ability to recruit blacks and other minorities in the science and technology area.

Answer. The Goddard class action suit was an unfortunate case that has been settled. However, there are many African Americans, other minorities and women employed by NASA in the science and technology area who have responsible positions and are happy.

NASA will aggressively leverage its alliances with minority and female professional associations and minority colleges and universities to increase the pools of minority and female candidates and bring them into the workforce.

Our recruitment strategy to increase minority interest in NASA jobs includes personal networking, greater use of the Internet to increase awareness about our job opportunities and extensive networking with professional associations and minority colleges and universities. Our Equal Opportunity offices, and the Minority University Research & Education Division (MURED), both have extensive networks with professional minority associations as well as minority colleges and universities. We plan to aggressively leverage these alliances to increase our candidate pools. For instance, by networking with principal investigators at minority colleges and universities we can ensure that we have access to minority students who are working on projects through our research and grant programs. We will use our personal networks with members of minority professional associations to post vacancies and showcase NASA as an employer of choice.

We have identified minority-sponsored websites to establish direct internet links from these web sites to our NASAJobs web site (<http://www.nasajobs.nasa.gov/>). This year, through the National Recruitment Initiative, we have sponsored direct links to NASAJobs from the Black Collegian, Blacks in Government, Women in Aviation, Hispanic Network and the Equal Opportunity Publication web sites. Adding instant access to NASAJobs from these websites will increase the level of job awareness and serve as a catalyst to increase the number of highly qualified minorities and women who apply for our vacancies.

Background Material

What has Goddard done so that this never happens again?

Goddard abolished the Manpower Utilization Review Council (MURC) in 1998, which was the genesis of the EO complaint. The MURC considered nominations for promotions to the GS/GM-14 and 15 levels that were outside the scope of authority delegated to heads of directorates. During the meeting, each such Director presented his/her cases. The MURC members then discussed their knowledge of each identified employee's duties and performance. The Center Director solicited comments from the MURC members about the individual's work performance and capability. The employee's position and its responsibilities were also considered and discussed. At the conclusion of the MURC, the Center Director made the final decision regarding promotion of candidates.

The Class charged that the MURC was a secret and unfair process. Some candidates were not told of their nominations while other supervisors did inform their employees of their nominations. Nevertheless, because there were typically more candidates brought forward to the MURC than could be promoted, the relative strengths of the cases made for one candidate versus another could affect the promotion outcome.

In response to concerns about the MURC process, the Center Director and Executive Council adopted a redesigned promotion process in January 1999 that required promotion criteria to be aligned with the Center's strategic plan, values, and goals. The redesigned promotion process delegated authority to Branch Heads to promote employees to all grade levels within their documented career ladder with higher level supervisory concurrence required for promotions to the GS-14 and 15 levels. Senior promotion criteria were published and standing panels were used for GS-14 and 15 accretion promotions. The panels served as advisors to management. The panels consisted of seven diverse GS-15 experts. There were four panels: Project Management; Engineering; Science; and Professional Administrative. The panels provided an independent assessment of a candidate's readiness for promotion against promotion criteria. They assured consistency in the application of promotion criteria across directorates and provided subject-matter expert evaluation of a candidate's skills and accomplishments. Decisions to promote resided with the supervisor. The redesigned promotion process provided organizations with an allocation of GS-14/15 positions so that they could manage their own resources. Additionally, employee promotions were published under the redesigned promotion process. In order to ensure accountability, directorates were required to present statistical information about promotions at EO Council meetings.

Despite the changes made in the redesigned promotion process, the Class charged during the course of mediation that the use of panels was unfair. The Office of Human Resources and subject matter experts from across the Center have since developed promotion criteria for scientists and engineers eliminating the need for promotion panels.

Employees have been afforded the opportunity to use a web-based tool to evaluate their supervisor's effectiveness in organizational communication; diversity (respect and inclusion); accountability; teamwork; human resources management; employee rewards; change orientation; and financial/technical/technological management. Aggregated input is discussed at staff meetings to help the supervisor develop an action plan to change behaviors. Additionally, employee input is considered when the supervisor's performance is assessed and when promotion, awards, within grade increases, and training decisions are made.

In an effort to ensure fairness and equity in the Center's performance management system, the Center strongly encourages supervisors to attend training sessions offered in the following subjects:

- Individual Development Plans
- Diversity
- Equal Opportunity
- Cultural Awareness
- Sensitivity Training

Most notable is a recent pilot training program that introduced over 100 Center managers to the topic of cultural assumptions specific to white American culture and their impact on employment decisions. The Center is planning to offer more workshops on the dynamics of race and power in order to raise the consciousness of supervisors about the experiences of people of color at Goddard. Supervisors will be required to complete a web-based EEO Essentials training course by the end of FY 2003.

Additionally, the Center has developed an Accelerated Leadership Program which will create a pipeline of diverse individuals to address under representation in su-

supervisory and management positions; accelerate development of leadership competencies; systematically develop individuals as Goddard's future leaders; and, provide promotion preparedness and a full performance level increase at the time of selection.

Moreover, the Center has started to take steps to effect a significant culture change. We have initiated a number of forums for dialogue with employees to understand their perspectives on race, gender, and other topics and how they affect their employment at Goddard. There are a number of minority and women advisory and directorate based groups that focus on diversity issues. We are using the NASA Leadership Model to ensure we provide our supervisors with more effective competency based training. We have begun to track the diversity of task and study teams with the goal of providing more opportunities for diverse employees to participate in these activities.

Pursuant to the Settlement Agreement, Goddard and Class Counsel have identified independent experts who will evaluate and if need be, redesign Goddard's existing performance management system which includes all processes governing accretion and career ladder promotions; awards; training; and performance awards. The independent experts will make recommendations to assist Goddard in developing and implementing a revised performance management system that is non-discriminatory and fair to all employees.

The revised performance management system will include, but is not limited to:

- a. Objective measures of performance.
- b. Standardized performance evaluations and assessment forms. Performance feedback to employees including annual reviews, performance goals, an appeals process, supervisory accountability, and training for Goddard employees.
- c. Standardized procedures governing the approval of accretion promotions. The requirement that supervisors and managers communicate regularly and openly with all employees within their area of responsibility about work assignment opportunities.
- d. Training supervisors on the purpose and process of establishing and using Individual Development Plans (IDPs). Requiring supervisors to offer employees at least annually the opportunity to discuss and/or establish an IDP. IDPs will identify the career objectives of the employee; be consistent with Goddard's mission; provide relevant assignments and training (on-the-job and NASA-sponsored); and provide any other grade-enhancing duties or responsibilities that are available.
- e. Providing career enhancement training to employees. The training will include information on the effective preparation of IDPs and career development.
- f. Training supervisors and employees on all aspects of the redesigned performance management system prior to its implementation.
- g. Developing processes and implementation plans to make accessible to African American scientists and engineers on a fair and non-discriminatory basis, participation in Goddard's "management-track" training programs.

The Settlement Agreement includes enforcement provisions. The Associate Center Director will provide oversight ensuring that Goddard honors all of the provisions of the Agreement. In the event Class Counsel feels that Goddard has breached any part of the Agreement, it may seek judicial enforcement of the Agreement. Additionally, Goddard is required to periodically provide Class Counsel with information about promotions, EEO complaints, and participants in management track training programs.

It is Goddard's objective to foster an organizational climate where employee diversity and mutual respect are catalysts for creativity and team effectiveness. Goddard management is committed to creating an environment where each individual can fully participate in the activities of an organization to his or her greatest ability without facing unnecessary obstacles. Goddard will take measured steps to achieve these objectives.

Question. One major issue confronting NASA and other federal government agencies is the declining number of students pursuing mathematics, science and engineering degrees. Is NASA able to attract engineering students as it competes with the higher-paying private sector for a shrinking pool of graduating engineers and scientists?

Answer. Over the past several years, competition for technical skills has become more intense and the need to offer recruitment incentives has increased. In FY 2001 there were fewer S&E hires than in FY 2000, yet almost twice as many recruitment

bonuses were needed to attract the FY 2001 hires than the FY 2000 hires. Eighteen percent of the new S&E hires in FY 2001 were given recruitment bonuses—in contrast to previous years in which the percentages were in the single digits.

To be more competitive with the private sector in terms of starting salaries, NASA Centers routinely offer advanced in-hire rates and use accelerated training agreements that enable eligible engineers at Grades 7 and 9 an opportunity to be promoted after six months at each grade level.

Question. What recommendations do you have for actions that Congress can take to create greater incentives for students in K–9, high schools, and universities to study mathematics, science, and engineering?

Answer. It is difficult to recommend any specific recommendations on actions that Congress can take to create greater incentives for students to study mathematics, science, and engineering. These incentives must come from a variety of places—schools, teachers, parents, the media, public and private sector organizations, and students themselves.

One of the priorities of the new NASA education program is to motivate students to pursue careers in math, science and engineering. We believe that one of the best ways to do that is to expose students to our exciting mission, and give them every feasible opportunity to take an active part in that mission—to get “hands-on” experience in our unique facilities and to interact with our extraordinary personnel.

Question. You mentioned the time and the amount of research that we can expect from a “chemical energy rocket” based mission to Pluto. (a) How much improvement can we expect from nuclear propulsion? (b) Are there other systems, besides propulsion, that may restrict the length of these deep space missions?

Answer. Nuclear fission power not only provides propulsion, but offers a host of other advantages as well, such as: (1) allowing a single spacecraft to visit multiple targets during a single mission; (2) providing more time for surface reconnaissance and discovery; (3) providing greater power for complex science instruments; and (4) allowing a higher rate of data return. Nuclear power will make space science missions much more resilient and adaptable, resulting in far more robust scientific discovery in terms of both quantity and quality.

Other spacecraft systems are limited by current technology, but with nuclear fission power, spacecraft capabilities (e.g., thermoregulation, power for instruments, data return rates) expand significantly.

Question. In a recent NASA letter that terminated the X–38 Crew Return Vehicle project, it was stated the project demonstrated that new flight systems can be developed significantly below industry cost norms, and the project team is to be recommended for its efforts. The project team was some of NASA’s finest. Will this model of utilizing federal employees for development work be utilized in more NASA projects in the future?

Answer. NASA agrees wholeheartedly that this team had exceptional people; they are being redeployed as the project comes to a closure in a manner that will fully utilize their individual talents.

It would certainly be our intention and desire to make full use of any and all processes that hold the promise of significantly reducing the development costs of Flight Systems. The application of this model to future NASA projects will be determined by the particular factors of a given project, including the appropriateness of using civil servant workforce on projects that could be performed by the private sector and the availability in the civil servant workforce of the needed mix of skills to undertake the development work.

Question. The Administration is currently reviewing the U.S. Global Change Research Program (USGCRP). One of the proposals is to have the Department of Commerce lead the program. Given the fact that NASA provides the majority of funding (about \$1.3 billion of the total of \$1.7 billion) for this multi-agency research program, do you feel that NASA should have a larger role in the program?

Answer. The President announced on June 11, 2001, that the Department of Commerce (DOC) is the lead for climate change research, including setting priorities, reviewing investments, and maximizing coordination among agencies. The administration announced further details on the organization of climate-related activities on February 14, 2002. NASA is participating in several capacities:

1. The Climate Change Science and Technology Integration Committee
2. The Interagency Working Group for Climate Change Science and Technology
3. The Climate Change Science Program Office (CCSPO)
4. The National Climate Change Technology Initiative

The CCSPO is an interagency group that includes representatives from the participating agencies: NASA, the National Science Foundation, the Departments of Commerce, Energy, Agriculture, Interior, and State, Office of Science and Technology Policy, Office of Management and Budget, and the Council on Environmental Quality. This interagency group will report to the Interagency Working Group on Climate Change Science and Technology, which in turn reports to the Committee on Climate Change Science and Technology Integration. The CCCSTI will provide recommendations concerning climate change science and technology to the President and will recommend the movement of funding and programs across agency boundaries, if needed, to better address climate change priorities . . . The inventory of climate change research programs is currently under review.

Dr. James Mahoney, the DOC lead for CCRI, has been communicating regularly with NASA on the Initiative, and has requested NASA's assistance to provide staffing for the CCSPO.

NASA's leadership in the essential role of providing the global perspective of Earth from space is well recognized in the Administration's climate change research management approach. NASA has been a leading force in shaping the scientific priorities and implementation strategy, and has a long history of supporting such efforts, including the USGCRP, and now the CCRI and ongoing USGCRP activities. NASA supports the Administration's recognition of the importance of addressing the leadership issue for the multi-agency climate change program.

Question. At the recent announcement of the preliminary 15 designs for the Strategic Launch Initiative (SLI), NASA set 2012 as the time in which a Second Generation launch system would be in place to transport crew and cargo to the International Space Station. NASA's Office of Space Flight recently began a study on the continual use of the Space Shuttle vehicles until 2020. What are the Administration's plans for replacing the Space Shuttle vehicles with the new Second Generation Launch vehicle?

Answer. The intent of the SLI program is to identify and close the technology gaps necessary to enable the development of a safer, less costly, commercially viable 2nd Generation Reusable Launch Vehicle (RLV) capable of fulfilling NASA's needs. The capabilities of the system will be, to the maximum extent practical, the result of a convergence of NASA and commercial needs. Currently, the program and its industry partners are narrowing the field of potential architectures and refining preliminary full-scale development cost and schedules. The architectures were narrowed from hundreds of possibilities to 15 concepts this past spring. The architectures are being narrowed further to the 3 prime candidates in support of the Architecture/Systems Requirements Review this fall.

The Integrated Space Transportation Plan (ISTP) is the governing framework that coordinates and guides NASA's various space transportation investments, including Space Shuttle improvements, Space Launch Initiative (SLI), and far-term space transportation technology. The Agency is currently reassessing its space transportation priorities as part of an update to the ISTP. Included in this activity is the Shuttle 2020 assessment outlining the cost impacts of extending the Shuttle operations to 2020.

As prudent planning, NASA is examining what upgrades to the Shuttle may be required in the event of delays or changes in the SLI development schedule. No decision has been made to extend the Space Shuttle's operational life to 2020.

Question. The April 29, 2002, issue of Space News reports that United Space Alliance personnel have used the E-Bay website to find sources of hard-to-find spare parts for the Space Shuttle. How serious a problem is this shortage of spare parts to maintain the Space Shuttle? How does this shortage affect Space Shuttle safety? How does this shortage affect NASA's plans to operate the Space Shuttle to 2012 or beyond?

Answer. The parts mentioned in the article were for non-flight ground support equipment. This shortage of the spare parts does not affect Space Shuttle safety or Space Shuttle operation to 2012 or beyond. The Space Shuttle fleet is safe to fly. Our commitment remains to maintain safety and reduce risk by implementing high priority upgrades, which are technologically feasible. Upgrades are required to ensure that the Space Shuttle supports the International Space Station through its lifetime, or as long as the Shuttle is required to fly.

Question. One major issue concerning all NASA centers is a degradation in facilities. The President's FY 2003 budget request includes funds for restoring the Kennedy Space Center's (KSC) Vertical Assembly Building (VAB) after the status of that building received a large amount of attention last year. Does NASA have a strategy for prioritizing the maintenance of its infrastructure?

Answer. NASA currently prioritizes its Construction of Facilities funding, which pays for major repair projects over \$500,000, within the NASA Programs and Enterprises. Facilities maintenance funding is prioritized at the Center and by specific programs.

With respect to prioritization of projects within Human Space Flight, NASA infrastructure projects will replace, repair and/or rehabilitate systems and capability that have become obsolete, degraded to a point where repair is not possible (replacement is necessary), spare parts are no longer available, or systems are in poor condition and must be upgraded and/or replaced. Priority considerations include: support of NASA goals and objectives, impact on flight hardware processing, manufacturing & testing, breakdown history, obsolescence, life cycle cost, payback, climate, weather and environmental situation. NASA has worked hard to identify the infrastructure projects necessary to enable the program to continue to operate into the foreseeable future. The NASA baseline and infrastructure revitalization requirements for all element locations were integrated into a single preliminary infrastructure requirements listing.

Question. One issue of great concern to the Members of this Committee is the amount of research that can be performed on the ISS. The International Space Station Management and Cost Evaluation (IMCE) Task Force found that there are no science priorities for ISS research. What actions will you take to establish priorities for ISS scientific research?

Answer. The Research Maximization and Prioritization (ReMaP) Task Force of 20 scientists has reviewed the current OBPR research portfolio in the context of external reports and recommendations received over the past 10 years and has made recommendations on research priorities to the NASA Advisory Committee (NAC). NASA will consider the recommendations of the NAC/Task Force along with the requirements from the other NASA enterprises in formulating priorities for ISS research.

Question. Will you adopt the IMCE's recommendation that the "highest priority" should be given to "research directed at solving problems associated with long-duration human space flight including engineering required to support humans in long-duration space flight?"

Answer. The members of the ReMaP Task Force were aware of the IMCE recommendations. NASA is reviewing the NAC/Task Force recommendations in the process of formulating its FY 2004 budget.

Question. What priority will be given to private sector and commercial research?

Answer. Commercial research was included in the science portfolio considered by the ReMaP Task Force.

Question. As the new Administrator, do you feel that NASA has adequately addressed the problems identified from the earlier failed Mars missions?

Answer. NASA and the Jet Propulsion Laboratory responded swiftly and addressed all of the findings of the Mars Program Independent Assessment Team (MPIAT), and the Mars Climate Orbiter (MCO) and Mars Polar Lander (MPL) failure review boards. In addition, the "lessons learned" identified in the MPIAT report have been addressed. These areas, and in particular the "lessons learned," are reviewed periodically to ensure that the Program does not fall victim to the same mistakes that plagued the failed MCO and MPL missions.

Question. In August, NASA circulated a draft Space Commercialization plan that met with mixed reviews. Does NASA intend to release a new draft Space Commercialization plan within the next few months?

Answer. NASA does not anticipate imminent release of a draft commercialization paper. NASA will factor space commercialization into the Agency's plans for implementing The President's Management Agenda.

Question. What opportunities do you see for greater private sector involvement in space operations?

Answer. The Administration issued The President's Management Agenda in August 2001, which set out a goal through the process of "competitive sourcing" to achieve efficient and effective competition between public and private sources where federal employees are performing tasks that are readily available in the commercial marketplace. NASA is seeking to achieve this goal as it pursues initiatives across the Agency, including initiatives related to the commercialization of space. Two early initiatives are underway to evaluate the opportunity and benefits to be gained from considering competitive sourcing for the continued operation of the Space Shuttle, and research utilization and commercialization activities on the ISS. NASA will achieve optimal safety and operational efficiency by determining the appropriate

balance between public and private sector participation in NASA programs and in developing and utilizing commercial capabilities and activities in space.

Question. NASA has tasked the RAND Corporation with studying possible business models to be considered for privatization of the Space Shuttle through competitive sourcing. What factors will RAND use to evaluate these potential business models?

Answer. In January 2002, NASA chartered an independent external Space Shuttle Business Review Team in January, consisting predominantly of industry expertise in financial, banking, investment, insurance and technical disciplines. A Business Review Team, comprised of industry experts from a variety of disciplines, including insurance, investment, financial, and technical fields, is performing a study that will identify various business options and their potential benefits for the Space Shuttle. As a minimum, these factors include: (1) identify checks and balances adequate to ensure continued safe operations; (2) ensure continuity of flight capability during any transition; and, (3) create and preserve the possibility for future competition. The President's FY 2003 Budget also lays out criteria under which a Shuttle competitive sourcing plan could be considered. NASA intends to use the Business Review Team's evaluation to prepare for this interaction with industry.

Question. How does RAND intend to evaluate the cost of privatization for the government? For example, if NASA sells the Space Shuttle, will it grant a private vendor a monopoly over transportation to the International Space Station?

Answer. Rand's evaluation and analysis are under NASA review and the final report is not due until this fall.

Question. In March 2000, NASA proposed eight Shuttle Safety upgrades. Of those, three were canceled (the Orbiter Electric Auxiliary Power Unit, the Reusable Solid Rocket Motor Propellant Grain Geometry Modification, and the Space Shuttle Main Engine Block II Study), and one (the Solid Rocket Booster/Thrust Booster Control) was deferred. What factors caused NASA to cancel and defer these upgrades?

Answer. For the EAPU, NASA determined that this upgrade was not technically ready to proceed with implementation due to immaturity that led to schedule slips and significant cost growth. This upgrade was cancelled.

The Reusable Solid Rocket Motor (RSRM) Propellant Grain Geometry Modification Upgrade was cancelled because further technical analysis did not support achieving the enhanced safety benefits initially expected with this candidate project.

The Space Shuttle Main Engine Block III was cancelled because initial studies indicated cost, schedule, and technical feasibility did not warrant proceeding.

The Solid Rocket Booster/Thrust Vector Control (SRB/TVC) was deferred due to higher funding priorities in FY 2003. The upgrade had successfully gone through Program Requirements Review and was deferred in case funds were made available.

Question. How will the cancel and deferral of these programs affect the safety of the Space Shuttle?

Answer. The Space Shuttle is safe to fly. Cancellation and deferral of several safety upgrades implies that the Space Shuttle will be operating at the current safety levels.

Question. How much money did NASA spend on these upgrades before canceling them?

Answer. Two million was spent on the SSME Block III study, no investment was made on RSRM Propellant Grain Geometry before it was cancelled; and \$12 million was spent on SRB/TVC before it was deferred. Although \$75 million was spent on EAPU before cancellation, the design studies could be utilized if the technology matures.

Question. What lessons has NASA learned from going through this process?

Answer. Major lesson learned was to complete technical reviews prior to committing firm development costs.

Question. What improvements does NASA intend to make to its process for studying the feasibility of future Space Shuttle upgrades?

Answer. Improvements to the process will consist of upgrading the selection criteria and systems analyses procedures (identify, screen, assess, and prioritize) and completing technical requirements reviews prior to establishing firm costs for development projects. Furthermore, NASA will continue to seek independent assessment advice on upgrades selection procedures from independent groups like the Space Flight Advisory Committee, the Aerospace Safety Advisory Panel, and the NASA Independent Program Assessment Office.

Question. The President's FY 2003 budget request calls for NASA to strengthen its ties with the FAA to ensure that NASA technology investments are incorporated into the national air system. What steps has NASA taken to achieve these goals?

Answer. In order to ensure that NASA technology investments are incorporated into the National Airspace System, NASA and the FAA signed a Memorandum of Understanding (MOU) in 1995 that established a formal partnership between the two agencies in Air Traffic Management (ATM) research. The agencies jointly manage an Inter-Agency Integrated Product Team (IAIPT) to conduct and coordinate research in the ATM arena. A National Plan is produced annually by the two agencies to identify, for the community, the specific research and development activities being funded by each of the agencies and the implementation plans for the resulting products. All ATM research efforts are considered, including those by industry that are funded by the agencies.

On October 9, 1998 NASA Administrator Dan Goldin signed an agreement with FAA Administrator Jane Garvey to work together on a strategic partnership between NASA and FAA to achieve national goals in aviation safety, capacity, and space transportation. (Ref: NSTC report November 1999: National Research and Development Plan for Aviation Safety, Security, Efficiency, and Environmental Compatibility.) This agreement recognizes the need for a coordinated federal effort to enhance aviation for the future. The agreement has established an FAA/NASA Executive Committee, which is charged with the responsibility of harmonizing our goals, establishing metrics, and monitoring success in these and other areas important to aerospace activities.

Under this umbrella framework between NASA and the FAA, there are numerous topic-specific Memoranda of Understanding reflecting harmonized interagency goals. These topic-specific Memoranda of Understanding lay the foundation for technology transfer from NASA to the FAA. NASA's role is to perform research resulting in technology demonstrations in relevant environments and the FAA's role is technology development for operational use and standards development. The four primary areas of technology transfer are Aviation System Efficiency (Air Traffic), Aviation Safety, Environment (Noise and Emissions), and Aviation Security.

NASA and the FAA have established a process to assist in the timely transfer of technology. This process calls for FAA involvement at earlier stages in the research, and NASA involvement (as an advisor) during the early implementation process. While this process is in its infancy, there have already been improvements in coordination and cooperation between the two agencies. For example, the agencies use NASA's Air Traffic Management System Development and Integration (ATM-SDI) contract to facilitate technology transfer. NASA contractors, who were awarded task orders to conduct research on air traffic management, will be funded by the FAA (through the ATM-SDI contract vehicle) to produce implementation documentation. This documentation will allow for consistency from initial concept through implementation. The risks and costs borne by the government will be dramatically reduced.

NASA and the FAA have signed a SATS-specific Memorandum of Agreement that establishes the working relationship for the most effective mutual use of each agency's competencies and facilities. The FAA is supporting the development of the requirements by providing operational and National Airspace System expertise. Currently, five FAA employees have been assigned to NASA and are working with the NASA SATS program office.

Question. The IMCE Task Force recommended establishing an Associate Administrator for the ISS, who would manage the ISS Program Office, and integrate scientific research requirements into the ISS program. The IMCE recommended this structure, because it would "significantly strengthen program control and financial analysis" at the program office and NASA Headquarters. Since you have endorsed many of the IMCE recommendations, do you intend to establish this new Associate Administrator position?

Answer. NASA is committed to significantly strengthening program control and financial analysis of the ISS program and improving the focus and integration of scientific research requirements into the ISS program. Since 1993, NASA has managed both the ISS and Space Shuttle programs within one office, the Office of Space Flight (OSF), in order to take advantage of natural linkages between these programs. Not only are their missions and schedules tightly coupled, more importantly, these two programs rely on the same heritage of human space flight technologies, systems, and operational processes, and of course, the personnel who bring these assets to bear. As such, NASA has decided to continue fostering synergy between the programs by continuing to manage both of them from within OSF.

In addition, the IMCE recommended organizational structure would not create the best environment for research. We felt strongly that we needed to develop a science-driven ISS program, and that the best way to achieve that was to strengthen the existing Office of Biological and Physical Research (OBPR). We need a vibrant ISS Research Program that will engage in pioneering science in space, leading to new discoveries that would inspire the next generation of scientists and engineers.

While NASA is not implementing the specific IMCE recommendation for a separate Associate Administrator for the ISS Program, we are implementing the intent behind the IMCE recommendation. In addition to improving the integration of the ISS and Space Shuttle programs, additional changes are being implemented to address the underlying concerns of the IMCE . . . These actions include:

1. *Tightening accountability at HQ and the ISS Program Office.* The OSF Associate Administrator (AA) is focused on rebalancing center director and program manager roles, improving financial management practices, clarifying accountability of personnel and resources, and streamlining reporting requirements. In particular, he has established and filled the new position of Deputy Associate Administrator (DAA) for ISS and Space Shuttle. The ISS and Shuttle program managers will no longer report to the JSC Center Director, but will report directly to the DAA for ISS and Space Shuttle Programs, who assumes full control of ISS and Shuttle program resources and reports directly to the AA of OSF.
2. *Basing staffing levels on program requirements, rather than institutional needs.* In accordance with a related IMCE recommendation that the ISS Program Manager “own all ISS personnel,” OSF is taking steps to fully transfer control of and accountability for civil servants who support the ISS program from the Center Directors to the Program Manager. These include more rigorous tracking of staffing levels by the ISS program, and the implementation of full cost policies and practices into the accounting, budgeting, and management functions.
3. *Improving coordination between OSF and OBPR.* The IMCE noted that the creation of an ISS AA position would address what it saw as a need for better coordination between OSF and the Office of Biological and Physical Research (OBPR). While such coordination is clearly important, NASA’s approach to ensuring a robust ISS program is focused on strengthening the accountability of OSF and OBPR for their respective roles in policy, planning, and program management. As a result, the ISS Research Capability budget was transferred from OSF to OBPR beginning in FY 2002.

Since NASA acknowledges that the joint OSF–OBPR management model for ISS must be science-driven, we are developing a good model for clear communications, coordination and accountability. The recently appointed Associate Administrator for OBPR brings valuable skills and experience in both program management and research to her new position. Additionally, NASA has established and filled a new position, patterned after a model employed successfully by our Space Science and Earth Science Enterprises, and designed to strengthen representation of the research community in ISS program management decisions. This position, the Program Scientist for ISS Research maintains a day-to-day interface with the Program Manager in Houston but reports directly to the OBPR AA. With OBPR in full control of the ISS research program, and clear roles for both OSF and OBPR, NASA is well equipped to ensure effective fiscal policy and planning coordination.

Science will drive the ISS program. To accomplish this, NASA has strengthened ISS management accountability while improving synergy between the ISS and Space Shuttle programs. This approach is enabling NASA to meet the performance goal prescribed by the NASA Advisory Council of ensuring “direct program control of personnel resources, as well as streamlined management visibility, reporting, control, and accountability.”

Question. The IMCE also found that “the centrifuge is mandatory to accomplish top priority fundamental research.” What is the status of the centrifuge, and will it be ready for deployment before 2008?

Answer. At a technical level, NASA and NASDA have agreed on a schedule, which will lead to launch of the Centrifuge Accommodations Module (CAM) in April 2007. This schedule is technically feasible. NASA is monitoring the situation with the Japanese budget for ISS and expects continuing dialog with NASDA regarding the CAM schedule.

Question. Some proponents of the ISS suggest that the United States should look for new international partners to help fund its construction. Some of the countries suggested as possible allies, include Ireland, Qatar, Kuwait, Saudi Arabia, and the

People's Republic of China. What actions has NASA taken to enlist more international partners?

Answer. NASA is aware of suggestions about seeking new ISS participants—either non-partner participants or international partners. NASA is not, as present, actively pursuing new ISS participants because, in accordance with the recommendations of the NASA Advisory Council (NAC), NASA is focusing on implementing the reforms within the ISS program to demonstrate the capability to achieve U.S. Core Complete within cost and schedule. As a first step, NASA is conducting a five-point assessment of the ISS program in the following areas: science priorities, engineering development and deployment, cost estimating and analysis, mission and science operations, and International Partner coordination.

NASA and its ISS Partners would like the benefits of the emerging ISS orbiting research facility to be available and utilized by the nations of the world. Should a nation indicate an interest in participating in the ISS to NASA, NASA would consult with the Department of State to ensure that participation is consistent with U.S. foreign policy goals and objectives, including those related to nonproliferation norms and guidelines. In addition to consultation with the Department of State, the participation of an additional nation in the ISS program would require notification to, and consensus by, the ISS Partners in accordance with the ISS agreements.

Question. Your written testimony highlights the importance of educators to engaging more students in mathematics, science and engineering degrees. What plans do you have for engaging teachers and professors in this mission to increase student's interest in mathematics, science, and engineering?

Answer. One of the priorities of the Agency's refocused education program is to provide educators with unique teaching tools and compelling teaching experiences . . . as only NASA can. NASA already enjoys a strong relationship with the formal education community and has many years of experience providing opportunities for educators to improve their ability to teach mathematics and science.

Under our new organization, we are developing several new initiatives that are designed to provide even more experiences for educators. The new Educator Mission Specialist Program will be one of the key components. The first EMS, Barbara Morgan, will soon be assigned to a Space Shuttle flight after completion of the International Space Station core configuration. We believe the opportunity to motivate teachers, inspire students, and engage the public through Ms. Morgan and future Education Mission Specialists will enable NASA to help reinvigorate the teaching profession.

Question. According to a NASA Inspector General report dated March 27, 2002, the IG examined 119 services acquisitions made in 2000 and 2001, which were valued at \$3.2 billion. Thirty-two of those services were available on the federal supply schedules. NASA contracting officers used the schedules for 20 of those orders (63 percent), while they did not use these schedules for the remaining 12 services. In 40 percent of the services acquisitions made through the federal supply schedule, contracting officers failed to follow proper procedures. What actions do you intend to take to ensure that NASA contracting officers use the federal supply schedules, and meet the requirements to get competitive bids before making purchases through the federal supply schedules?

Answer. Because the procedures for using Federal Supply Schedules (FSS) are described in Federal Acquisition Regulation (FAR) Subpart 8.4 and special ordering procedures for FSS service contract orders are separately prescribed by GSA, the NASA Office of Procurement has issued new formal guidance to its procurement personnel to follow both the FAR and the GSA ordering procedures. In addition, the Office of Procurement is arranging for GSA to provide on-site training at NASA centers on the appropriate use of FSS. Compliance with FSS ordering procedures, including the requirement to review the offerings of multiple FSS contractors before placing an order, will be monitored as a special area of concern by the Office of Procurement through its periodic reviews of each NASA center's procurement operations.

NASA Strategic Resource Review (SRR)

Final Report

August 2002

This briefing serves as the final report regarding NASA's Strategic Resource Review (SRR).

Contents

- Background
- Purposes of the SRR
- Timeline
- President's Management Agenda and NASA Vision & Mission
- SRR Results Summary
- Criteria for Review of SRR Actions
- SRR Review Board Results
- Actions
- Observations
- Conclusions

Background

President's FY2002 Budget, "Blueprint for New Beginnings," released Feb 28, 2001:

- Pursue management reforms to promote innovation
- Open Government activities to competition
- Improve the depth and quality of NASA's research and development (R&D) expertise

Administration guidance accompanying the FY 2002 Budget: Develop integrated, long-term agency and Center plans that ensure a national capability to support NASA's mission:

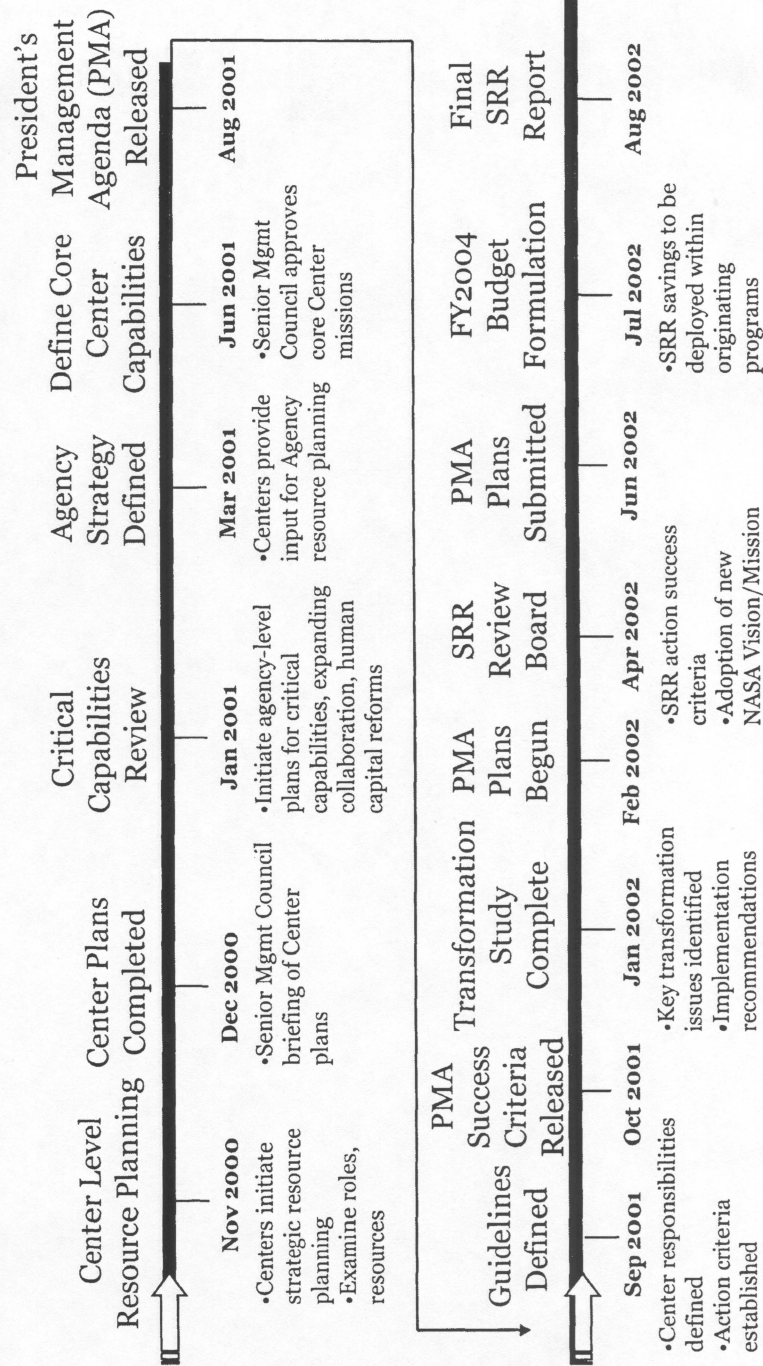
- Identify critical capabilities
- Expand collaboration with industry, universities, other agencies and outsource appropriately
- Determine capabilities that NASA must retain

Broad Congressional interest in long-term alignment of NASA's critical technical and managerial skills, funding resources, mission activities, facilities, and core competencies.

Original Purposes of SRR

- Develop a comprehensive agenda and strategy
- Identify what NASA should look like in 10 years
- Examine center responsibilities, resources, competencies
- Assess which capabilities should be retained, discontinued, or led outside NASA
- Determine ways to expand long-term strategic alliances with university, industry, and government partners
- Address requirement to recruit/retain needed competencies, and resolve skill gaps
- Conduct detailed review of facilities and address modifications, deletions, and additions

Timeline



President's Management Agenda and NASA Vision & Mission

- President's Management Agenda (PMA) released August 24, 2001 – Government-wide initiatives:
 - Strategic Management of Human Capital
 - Competitive Sourcing
 - Improved Financial Performance
 - Expanded Electronic Government
 - Budget and Performance Integration
- Standards for Success for the Government-wide Initiatives under the PMA issued on October 31, 2001
- NASA evaluates original SRR activities in light of the PMA
- Several issues emerged during SRR as Agency-wide transformational challenges that could benefit from the principles in the PMA
 - NASA Competitive Sourcing planning
 - NASA Human Capital planning
- Concurrent with NASA's implementation of the PMA, NASA adopts a new Vision & Mission.

SRR Results Summary

The SRR effort resulted in a compendium of actions, including:

- Refinement and reaffirmation of Center primary responsibilities
- Identification of Agency-wide initiatives
- Implementation of specific Center and inter-Center actions

Agency-wide efforts subsumed within the President's Management Agenda

SRR Center/inter-Center actions implemented:

- ~ 150 proposals identified
- Proposals narrowed to 126 candidate items
- Review board established
- Responsibility for implementation assigned at Enterprise and/or Center level

Criteria for Review of SRR Actions

SRR Review Board convened in April 2002. For implementation of an action, at least one of the following must be met:

- Expands opportunities for industry and universities to participate in NASA programs
- Promotes innovations or efficiencies in operations
- Achieves savings for redeployment to priority missions and capabilities

SRR Review Board Results

Of the 126 Actions¹:

- 40 Actions implemented
 - Estimated investment cost \$3M, estimated net savings/cost avoidances \$48M
- 14 Actions being implemented or ready to implement
 - Estimated investment cost \$24M, estimated net savings/cost avoidances \$65M
- Remaining actions require further study, are combined with other ongoing Agency efforts, or are rejected
- FY 2004 Budget formulation – SRR savings reallocated to originating program

¹Note that all cost/savings/cost avoidances are based on the 5-year period through FY07

Actions

40 Actions implemented (approximate net savings/cost avoidance)	
No.	Action
1	Identify the Optimum Size of the Astronaut Corps
2	Defer JSC Small EMU Program (approx. \$9M)
3	Reduce ETB by 10% with No transfer to Programs (approx. \$13M)
4	Consolidate Basic Operations Contracts at GRC/Plum Brook
5	Commercialize Visitor Center (approx. \$1M)
6	Planetary Science Partnerships w/ Universities
7	KSC Space Experiment Research & Processing Laboratory (SERPL)
8	Establish KSC International Space Research Park
9	Expand MSFC NSSTC to Cover Microgravity & Optics
10	Establish NASA Publications Policy
11	Expand Use of IPA's, Pay Banding, Extended Terms, etc.
12	Broader Earth Science Customer Base
13	Mothball JSC Manipulator Development Facility (MDF); convert RMS training to graphics-based (approx. \$6M)
14	Place JSC Thermal Vacuum Chamber A on Standby Mode
15	Evaluate Closure of Additional MSFC Facilities (approx. \$7M)
16	Excess the Two Gulfstream-I Aircraft; Determine if Service Contracts Can Furnish On-Demand Services & Enable Excessing Administrative Aircraft
17	Explore focusing NASA/National UAV development / flight test capability at DFRC/Edwards
18	Evaluate phasing out earth science civil servants @ MSFC; maintain support through competed grant work

Actions (continued)

40 Actions implemented (approximate net savings/cost avoidance)	
No.	Action
19	Pursue Development of Research Park to do Earth Science Work
20	Identify 10% Overhead Savings At JPL for Reinvestment
21	Explore Options for Reducing Cost of Contractor Leases
22	Evaluate Methods for Reducing Resource Investment In Special Events at JSC (approx. \$1M)
23	Explore Alternate Funding Sources for JSC CCISD Agricultural Science Learning Lab (Longhorn)
24	Re-Evaluate All JSC Non-Reimbursable Agreements Based on JSC Benefit
25	Phase Out Super Guppy After S6 Delivery
26	Eliminate the G-1 by CY 02
27	Cancel ICM & Discontinue ICM Caretaker Support (approx. \$2M)
28	Maximize Use of Off-Site Commercial Payload Processing Facilities (approx. \$2M)
29	Authorize Non-Government Use of On-Site Facilities
30	Lead SLI "Operations" Partnerships with Other Centers & USAF
31	Review Requirement For Earth Science Functions @ JSC
32	Consolidate engineering standards subscriptions
33	Consolidate all NASA rocket propulsion test support contracts across the Agency (approx. \$5M)
34	Implement full cost accounting throughout NASA
35	Review/update FAIR inventory, ensuring Agency-wide consistency in interpretation/reporting
36	JSC Space Science (Planetary Curation); Reduce Lunar/Planetary Curatorial
37	The Future of Space Science at MSFC
38	Requirements for Earth Science Function (approx. \$1M)
39	Conduct External Program Reviews
40	Increase Competition for New Ideas

Actions (continued)

14 Actions Being Implemented or Ready to Implement (approximate net savings/cost avoidance)	
No.	Action
1	Examine Privatizing NASA TV (approx. \$30M)
2	Consider outsourcing &/or consolidating plating shops, as driven by highest priority RD&T requirements; determine if common Agency source(s) is (are) available (approx. \$4M)
3	Consider Consolidating Technical Wet Film Labs (approx. \$12M)
4	Outsource GSFC Training Function (to be implemented as part of Consolidated Business Office)
5	Consolidation of JSC Arc-Jet w/ARC Arc-Jet Facility (approx. \$7 M)
6	Establish Common IT Infrastructure: Provide Standard Desktop Software Loads
7	NASA Corporate Directory (approx. \$1M)
8	Define & Implement Web Management Model
9	Secure Nomadic Access (approx. \$1M)
10	Agency Security Perimeter: A Centralized Implementation & Management of Agency's Firewall & Intrusion Detection Systems (approx. \$7 M)
11	SBIR/Venture Capital Partnership
12	Establish common IT infrastructure: Extend ODIN Refresh Schedule
13	Virtual Engineering Environment - Collaboration of MSFC & JSC Engineering (approx. \$3M)
14	University Initiative

Observations on SRR

- SRR was an examination of existing processes
- Legislative authorities requested not enacted
- Initiated prior to current Vision and Mission, “Pioneering the Future”
- No pre-established targets for workforce levels or savings
- Modest achievements
- Served as catalyst for initiatives under President’s Management Agenda (PMA)

<u>Original Purpose</u>	<u>Outcome</u>
Comprehensive agenda and strategy	PMA & Vision/Mission
How should NASA look in 10 years	Vision/Mission, Strategic Human Capital Planning
Examine Center responsibilities	Refined/reaffirmed primary responsibilities
Assess appropriate capabilities	To be assessed via Competitive Sourcing Plan
Expand alliances	Various ongoing activities underway
Recruit/retain needed competencies	Strategic Human Capital Plan/Implementation Plan tools
Review of facilities	Completed, via Center and Agency review

Conclusions

- The Strategic Resources Review was initiated in early 2001, in response to the President's FY2002 Budget "Blueprint," Administration guidance, and broad Congressional interest. This report formally concludes the SRR as a separate activity.
- The SRR resulted in the implementation of a number of Center actions, and served as a catalyst for Agency level reviews of capabilities, resources, and human capital needs.
- Begun as the Critical Capabilities Review, the SRR identified Agency-level interests that are being addressed as part of the President's Management Agenda and NASA's new Vision & Mission.
- Agency-wide strategic interests will be accommodated through NASA's Competitive Sourcing Plan and NASA Strategic Human Capital Plan and Implementation Plan, which have been submitted to OMB.
- Center and inter-Center results have been achieved and are being implemented
 - Cost savings/avoidances through FY 2007 are approximately \$100M, after an investment of approximately \$30M. Savings for actions requiring further study are TBD.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. BILL NELSON TO
SEAN O'KEEFE

Shuttle Replacement Timeline

Question. The Space Launch Initiative (SLI) is supposedly designed to help find a replacement vehicle for the Shuttle. While this program appears to be well thought out, we have heard several different dates as to when we should anticipate the Shuttle being replaced. What is the expected initial operational capability (IOC) date for the replacement reusable launch vehicle system? Do you have a transition plan that lays out the orderly replacement of the Shuttle while maintaining a safe,

reliable means for human access to space? If not, when do you expect to have such a plan? In time to influence NASA's authorization bill, which is up for renewal this year? In time to influence next year's (FY 2004) appropriations bill?

Answer. The SLI program goal is to provide the necessary scientific and technological data required to design, evaluate, and formulate realistic plans leading to a Full-Scale Development (FSD) Decision in 2006. NASA is pursuing priority investments for designing the 2nd generation system, maturing critical subsystems to technology readiness levels, and developing credible cost and performance estimates. The current target date for IOC is 2012.

The Integrated Space Transportation Plan (ISTP) describes the transition plan between the Shuttle and the Second Generation Reusable Launch Vehicle. NASA has an effort underway to update the ISTP to reflect an integrated Agency-wide strategy for this transition. The appropriate time phasing between Shuttle and the replacement vehicle will be a key output from this study. The intent is to have this effort complete in time to support the FY 2004 Budget.

Shuttle Upgrade Timeline

Question. NASA's budget outlook and the current upgrade strategy are based on the premise that the Shuttle will be retired in 2012. But, last fall, this committee heard testimony from five expert witnesses—from inside and outside of NASA—who agreed that the Shuttle fleet will not be retired for another decade or more. I understand that your agency recently issued a directive to officials at Johnson Space Center to identify upgrades and supportability investments that may be required to fly the Shuttle fleet safely through 2020. This is a small step in the right direction. If this and other ongoing studies do ultimately recommend that the Shuttle fleet remain viable until 2020, will NASA revise their current safety and supportability upgrades, as well as infrastructure revitalization requirements to account for the longer flight expectancy?

Answer. As a prudent planning exercise, NASA is currently assessing the Space Shuttle elements supportability and upgrade candidates for hardware, infrastructure, obsolescence, and review of human capital investment required to operate the shuttle beyond 2012. The primary objective of this activity is to understand options for maintaining safe Space Shuttle operations through 2020. No decisions have been made to extend shuttle operations beyond 2012.

SLI in the Long-Term: Help or Hurt Industry?

Question. The Space Launch Initiative (SLI) is ostensibly designed to accomplish two goals: (1) choosing and developing a human-rated reusable launch vehicle (RLV) to replace the Shuttle, and (2) assisting the commercial launch sector with revolutionary leaps in technology, so as to increase commercial launch reliability and dramatically reduce the cost of access to space. These sound like excellent goals, and I am completely supportive of this program. It is my understanding that, at the end of several "decision gates" within the SLI architecture, NASA will reach a decision on which one-vehicle to build to replace the Shuttle. And, it is expected that this vehicle is to have commercial cargo value as well as being human-rated. But, if NASA develops a vehicle with dual commercial and civil purposes, how would that not amount to the government picking which company or consortium should dominate the commercial launch market? In this regard, do you believe that SLI's architecture is ultimately designed to assist industry? Or to compete with it?

Answer. The goal of the SLI program is to develop the technologies and vehicle architecture that will enable development of a reusable launch vehicle that provides a safe, reliable, low-cost access to space. This can be a key enabler for civil space exploration, National security, and the commercial development of space. One of the fundamental principles of the SLI program is to create a competitive environment to assure the best and most innovative ideas are developed by the Program. There are currently 23 Prime Contractors performing various technology development and architecture definition activities, evidence that SLI is taking advantage of a broad spectrum of corporate expertise.

NASA intends to have the second generation reusable launch vehicle be commercially operated. NASA will not directly compete with industry for the commercial market segment. It is true that the company ultimately selected to be the Prime Contractor could have a strategic advantage when trying to capture the commercial market segment of the launch industry. However, this company will not be certain to dominate the launch market. In particular, the planned reusable launch vehicle would likely be much more competitive with expendable launch vehicles in the larger GEO satellite market than in the smaller market. This market segment has recently been dominated by non-U.S. systems. It is expected the added competition

and broad-based technology development activities will provide benefit to considerably more than just the prime contractor.

Ultimately, NASA believes that development of a safe, reliable, low-cost access to space will open up many more business opportunities for the benefit of a broader range of the U.S. aerospace industry than exists today.

Shuttle Workforce Layoffs

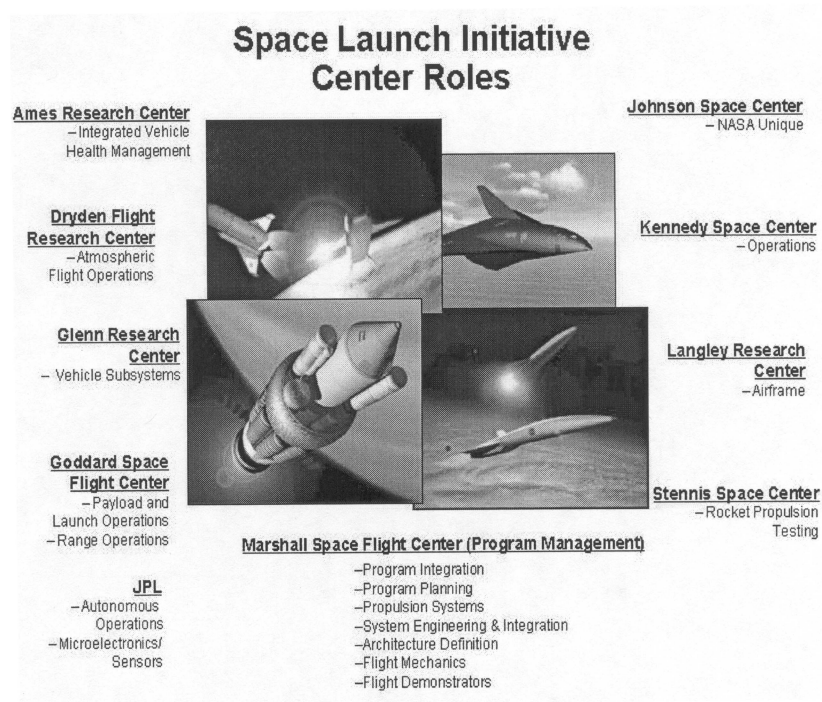
Question. Lockheed Martin announced a layoff at their Shuttle External Tank facility in New Orleans, Louisiana. I believe such layoffs will ultimately result in the loss of crucial know-how on the Shuttle program, expertise that would surely be required if/when the Shuttle begins to fly at a higher flight rate down the line. Do you anticipate additional contractor layoffs as a result of the reduced Shuttle flight rate? What about NASA impacts? Are you confident that you will be able to quickly ramp back up in personnel and expertise, should such a future ramp-up be necessary?

Answer. The reduced flight rate of four a year applies only to ISS Assembly flights—we retain the flexibility to fly additional flights, assuming that NASA or Commercial/DOD requestors can provide funding for these flights. As a result of a recently signed contract with Lockheed Martin, we have retained the flexibility to produce no less than six External Tanks a year. Because of the possibility of additional Shuttle flights, it would be premature to speculate on contractor layoffs at the present time. If additional flights are added, NASA will retain the appropriate personnel and expertise.

Space Launch Initiative: Division of Labor.

Question. The Space Launch Initiative is currently budgeted at about \$5 billion total over the lifetime of the program. How are the programs related to SLI being divided among NASA center? How does each center's role as a "center of excellence" relate to this division of labor? When a Shuttle follow-on vehicle is finally selected, and the technology is locked-in, where do you anticipate this program to be based? Do you believe that the Cape will continue to be the leader within the agency for space launch?

Answer. Ten NASA Centers are involved with the Space Launch Initiative program. The support each Center provides is closely aligned with its core expertise. The contribution of each Center is summarized in the figure below.



There has been no final decision on either the program management structure for the flight vehicle or which Center will manage the vehicle development phase. Although final decisions have not been made on the roles and responsibilities of each Center in these phases, it is likely that the support will continue to be broad-based to take advantage of each Center's core expertise, including KSC's expertise in launch operations.

Shuttle, SLI Synergy

Question. Is there a plan to reorganize the SLI and the Shuttle programs under one Space Transportation Program Executive Official [PEO] at NASA headquarters? If so, please describe it. If not, doesn't it make good sense to have synergy between the two programs so the lessons learned from the Shuttle program that could be applied to the follow on?

Answer. Currently, NASA has no plans to reorganize the Agency such that the Shuttle and SLI programs report to a single Program Executive Official (PEO). As SLI is primarily a technology development program, it relies heavily on the expertise of the research and technology personnel and resources managed by the Office of Aerospace Technology. Shuttle, on the other hand, is an operational vehicle and relies heavily on the launch operations expertise and facilities managed by the Office of Space Flight. Being the only reusable human-rated launch vehicle, the Space Shuttle is used as the "lessons learned" reference point for the SLI program. As an example, the Shuttle integrated operations models are the starting point for developing SLI architectures and assessing proposed and maturing technologies. In general, the SLI team honors the lessons learned from programs that came before and is being guided by independent review panels and subject matter experts. Synergy between the programs has also been attained by assigning Shuttle-experienced personnel to the SLI program. Technology roadmaps are also being tuned as well as other cooperative Agency planning through the Integrated Space Transportation Plan update activities this year.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. BARBARA BOXER TO
SEAN O'KEEFE

Orbiter Major Modification (OMM)

Question. In making the decision to relocate the OMM from California to Florida, what assumptions did NASA make about the availability of skilled workers in the Florida location? Were any labor market surveys performed? If not, why not? If so, please provide them.

Answer. United Space Alliance (USA) is NASA's prime shuttle operations contractor. United Space Alliance employs over 6,000 workers in Florida whose jobs are technically similar to those of the Boeing workers who have completed Orbiter Major Modification (OMM) in the past. United Space Alliance and their predecessor, Lockheed Martin, have had no difficulty hiring highly skilled initial and replacement workers over the 21 years of Space Shuttle operations. Due to USA's annual labor market surveys and ongoing compensation surveys, coupled with the constant replacement hiring, USA is extremely familiar with the local markets and did not find it necessary to conduct an additional labor market survey.

Question. What data were used by NASA to determine that approximately 235 new workers would need to be hired at KSC? Does this number include management and professional employees?

Answer. The number of new workers is not 235. The 235 represent the total USA planned budgeted workforce. The United Space Alliance Management and Planning team is familiar with the work content and are experienced and skilled at planning the completion of the work at a very detailed level. The quantity of workers required to complete the inspections and modifications on OV-103 was developed from the detailed work content and is a combination of both current and new hires. OMM hiring is complete and is included in the FY03 President's budget. The 235 total workers include 21 logistics support personnel and 214 technical and engineering personnel. Management has been drawn from the existing Orbiter Element and Ground Operations Element teams. Boeing will supply design-engineering skills on subcontract to United Space Alliance.

Question. What data and calculations did NASA rely on to determine the costs associated with recruiting, relocating and training approximately 235 new employees at KSC?

Answer. United Space Alliance routinely hires and trains technical personnel in Florida to fill the jobs that are vacated through natural attrition. The hiring of additional technical workers is not unusual and fits well within the experience base. Hiring for OMM is complete. The USA plan is to budget at the 235 level. The majority of the hires have been local which required no relocation expense. Training cost requirements are negligible because training processes and curricula exist for the processing workforce and are offered on a recurring basis and require no additional costs.

Question. NASA concluded that 400 employees would have to be re-hired at Palmdale but that only 235 will have to be hired at KSC. How does NASA account for the difference of 165 employees? Did NASA assume that 165 employees currently working at KSC will take on additional duties related to the OMM? If so, what data and calculations did NASA rely on to determine that 165 employees could both continue current workload and add work related to the OMM?

Answer. Boeing's workforce at Palmdale peaked at around 400 workers during short periods on past OMMs, but the Boeing number of workers associated with the OMM and submitted in the FY01 Program Operating Plan was 320 equivalent headcount. The USA plan requires fewer workers than required by the Palmdale facility. Based on utilizing synergies of a common workforce, United Space Alliance's plan uses 235 workers plus 30 Boeing engineers for design engineering support to perform OMM's at the Kennedy Space Center (KSC).

Question. What data and calculations did NASA rely on to determine the costs associated with training and upgrading the skills of the 165 current employees who presumably would be assigned to work on the OMM?

Answer. The USA plan for performing OMM at KSC requires fewer workers than required by the Palmdale facility. The total number of USA employees who will work on the OMM is approximately 235 plus 30 Boeing engineers for design engineering support. NASA relied on USA estimates for hiring, training, and certification costs associated with the OMM. The work associated with structural inspections and the major modifications that will occur during the OV-103 OMM are similar to the structural inspections, wire inspection and repair, and "in flow" modifications that the United Space Alliance workforce at KSC has routinely accomplished

during the life of the Space Shuttle Program. The costs to hire, relocate, train, and certify the workers that will conduct the OMM are included in the cost to conduct the OMM.

Question. Where did NASA assume the OMM would be performed at KSC? How did NASA calculate and weigh the costs associated with providing a facility for the OMM at KSC?

Answer. NASA and United Space Alliance will perform OMM's in existing Orbiter Processing Facilities (OPF)—a new or refitted facility is not required. Orbiter Vehicle 103 was located in OPF Bay 1 where post-landing work and some preliminary wire inspection has been accomplished. As planned, it was moved into OPF Bay three in early July to begin its OMM on September 1, 2002. Reduced flight rate alleviates processing dependencies on OPF's.

Question. What is NASA's understanding of the accuracy of media reports that the OMM will be performed in a Florida Space Authority hangar, requiring \$24 million to retrofit? If the reports are accurate, who will pay the retrofitting costs and when will the retrofitting be completed?

Answer. News media reports that the Shuttle Landing Facility (SLF) Hangar facility owned by the Florida Space Authority and leased by United Space Alliance would be used for OMM work are incorrect. The SLF Hangar was not considered an appropriate facility to conduct an OMM. United Space Alliance is using the SLF Hangar to store ground support equipment. USA plans to conduct the work and support the Shuttle manifest using the existing facilities in the KSC's Orbiter Processing Facility and the Vehicle Assembly Building. A new or refitted facility is not required for the OMM. The shuttle program can support up to six flights per year without adding any new facilities for OMM work.

Question. Many employees (active and awaiting recall) from the Palmdale, California facility have received offers to relocate to KSC in Florida. How many employees have been contacted individually and how many have agreed to relocate? How many people attended the recent "job fair" to recruit skilled workers to relocate to Florida and how many agreed to relocate? Please provide copies of the offers being made to California workers to relocate to Florida.

Answer. In September 2001, and March 2002, United Space Alliance held an "Open House" in Palmdale for the purpose of interviewing and extending offers to Palmdale employees to relocate to KSC in Florida. Approximately 300 attended the September event, and 90 attended the March event. Only 25 employees possessed the skills needed to perform the work and were willing to relocate. USA extended 25 relocation offers, of which 15 have been accepted. Currently there are no offers pending to California workers to relocate to Florida.

Question. Please provide a copy of the "independent cost and risk assessment" conducted by JSC Systems Management Office on which NASA relied in making the decision to relocate work from California to Florida, as well as a copy of the request to JSC to perform the assessment.

Answer. The JSC Systems Management Office independent cost/risk assessment is attached as Enclosure 1. Additional independent cost assessments were performed (see Enclosure 2). All three assessments indicated that cost savings would be realized in moving OMM from Palmdale to KSC. The request to JSC for the independent cost and risk assessment was made verbally.

Question. Does NASA intend to maintain the Space Shuttle-related work currently being performed at Palmdale in California or will that work be relocated out of California in the future?

Answer. USA and Boeing are conducting studies to determine the best location to complete the Space Shuttle work that currently is done at Palmdale. It is likely that the recommendation will result in a lower cost location, either in California or in another state.



Space Shuttle OV 103 OMM
KSC vs Palmdale Cost/Schedule Assessment

	<u>KSC</u>		<u>Palmdale</u>	
Preplanning	3 M	6 Months	10 M	6 Months
MCR's:				
KSC:				
21	53 M	12 Months		
33	14 M (1)	(Opportunity Based)		
Palmdale:				
32			81 M	12 Months
21 (@KSC)			10 M	7 Months
Cost/Schedule Risk (2)	35 M (3)	8 Months	20 M	3 Months
Total Cost w/risk.	<u>105 M</u>		<u>121 M</u>	
Estimated to OPF (w/risk)		May '04		May '04

- (1) Prior Orbiter processing experience has shown that minor modifications such as these can be incorporated into the flow without cost impact potentially saving this 14 M.
- (2) Cost of schedule risk is subjective and based on a Risk Matrix and is "worst case".
- (3) A stable KSC workforce and the ability to share resources with other vehicle OPF activity could reduce this value.

James Rush 11/21/01

Enclosure 1

Space Shuttle Program Orbiter Major Modifications

Space Shuttle Program OV-103 OMM Cost Assessment December 2001

Palmdale/KSC		KSC Only	
Palmdale Preplanning	9.9 M	KSC Preplanning	2.9 M
Palmdale GSE Upgrade	5.2 M	GSE Upgrade	1.1 M
Palmdale OMM	70.4 M	HSF&E Support	6.1 M
Orbiter Ferry	2.0 M	KSC OMDP	43.2 M
USA Palmdale Support	3.4 M	Total USA OMDP	53.3 M
USA Mod Implementation	10.1 M	KSC NASA QA	2.4 M
Total	101.0 M	Total	55.7 M
		USA Mod Implementation	14.0 M
		Total	69.7 M

Second Cost Assessment December 2001

OV-102 Cost	162 M
OV-104 Cost	88 M
OV-103 Projected Cost	60 M
(7 M Reserves Held by Program)	
Cost Savings (Subtotal)	28 M
Travel Cost (747)	2 M
Total Cost Savings	30 M

(Used OV-104 Because it is more comparable to OV-103 OMM)

Enclosure 2